Holistic Approaches to Palliative and End-of-Life Care for the Elderly: A Survey

Abstract

This survey paper systematically explores the landscape of palliative and end-of-life care, emphasizing holistic and compassionate practices aimed at enhancing the quality of life and death for elderly patients and their families. It evaluates the integration of large language models (LLMs) in nursing and elderly care, particularly in patient monitoring and personalized care, and assesses the potential of these technologies to improve patient outcomes. The survey also provides practical guidance for anesthesiologists and intensivists on implementing palliative care in intensive care units (ICUs), thereby improving symptom management and family support. Additionally, it offers a comprehensive overview of multimodal approaches for non-contact indoor human monitoring systems relevant to elderly care. By identifying gaps in evidence for integrating palliative care into advanced heart failure management, the survey aims to improve outcomes for patients and caregivers. It explores the integration of socially assistive robots (SARs) in elderly care, focusing on their roles and interactions with elderly participants. The survey also addresses the challenge of converting unstructured sensor data into structured event logs for analysis, exploring efficient methods for such transformations and the implications of efficient computation of counterfactual bounds in structural causal models. Through these objectives, the survey provides a comprehensive synthesis of current practices and innovations in palliative and end-of-life care, ultimately guiding healthcare service planning and resource allocation.

1 Introduction

1.1 Importance of Palliative Care in Elderly Care

Palliative care is essential for enhancing the quality of life in elderly patients, particularly those with severe, life-limiting illnesses. It addresses the complex health needs of this demographic, akin to methods that improve predictive accuracy in survival analysis [1]. Timely interventions and comprehensive monitoring are critical to ensure appropriate support in healthcare settings. Innovative technologies, such as AI-based ambient sensing systems, further enhance palliative care by providing timely reminders and assistance [2].

The growing elderly population, especially in regions like China, underscores the urgent demand for qualified nursing care [3]. Holistic palliative care strategies, which include emotional and social support, have shown to improve patient satisfaction and quality of life while reducing the need for aggressive end-of-life treatments [4]. Effective patient-centered communication is crucial in this context, as it addresses sensitive topics and enhances care delivery [5]. This focus on patient-centered care is vital for improving elderly patients' quality of life [6].

Moreover, palliative care significantly impacts ICU settings by enhancing symptom management and providing family support [4]. Addressing racial disparities and communication barriers is also essential for equitable end-of-life care outcomes [7]. As patients with advanced illnesses approach the end of life, the likelihood of adverse events increases, highlighting the necessity of palliative care

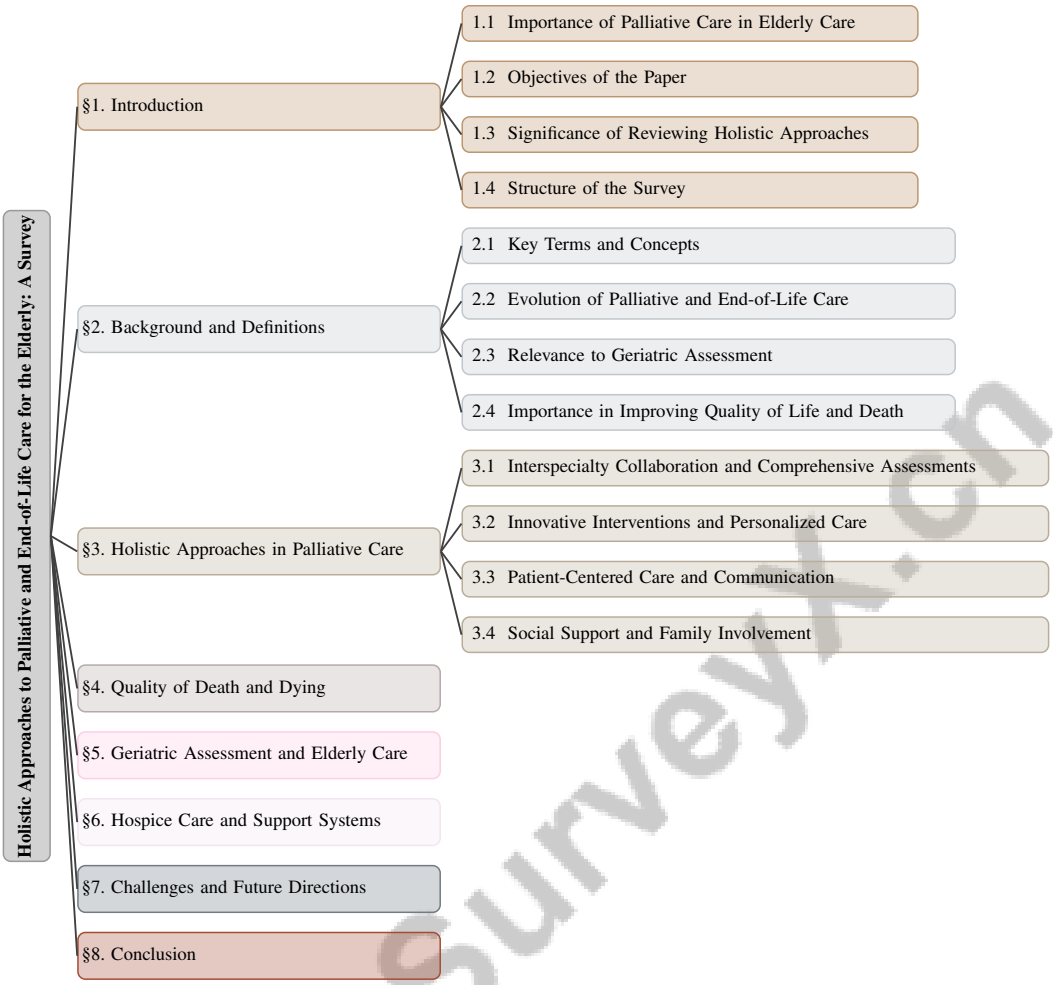


Figure 1: chapter structure

for improving their quality of life [8]. Integrating palliative care into the management of advanced heart failure is critical, as it can markedly improve quality of life [9].

The effectiveness of palliative care extends beyond symptom management to encompass comprehensive, patient-centered care and interprofessional collaboration, addressing both medical and emotional needs of patients and their families. Transforming raw IoT data into actionable insights is also vital for better decision-making in elderly care [10]. Additionally, the application of socially assistive robot (SAR) technology is increasingly important due to the growing elderly population [11]. Informed decision-making, supported by efficient computational methods for counterfactual queries, is crucial for enhancing the quality of life in elderly care [12].

1.2 Objectives of the Paper

This survey systematically explores the landscape of palliative and end-of-life care, focusing on holistic and compassionate practices aimed at enhancing the quality of life and death for elderly patients and their families. It evaluates the integration of large language models (LLMs) in nursing and elderly care, particularly in patient monitoring and personalized care, assessing their potential to improve patient outcomes [3]. By examining user experiences and technological challenges at the intersection of elderly care and conversational AI, the survey seeks to enhance patient engagement and communication [13].

Furthermore, the survey provides anesthesiologists and intensivists with practical guidance for implementing palliative care in ICUs to improve symptom management and family support [4]. It offers a comprehensive overview of multimodal approaches for non-contact indoor human monitoring

AI-generated, for reference only.

systems relevant to elderly care, addressing challenges in evaluating the impact of palliative care on emergency department visits for patients with advanced illnesses.

The survey also identifies gaps in evidence regarding the integration of palliative care in advanced heart failure management, aiming to improve outcomes for patients and their caregivers [9]. Understanding patient values in healthcare experiences is another key objective, enabling tailored care strategies [6]. Additionally, the exploration of socially assistive robots (SARs) in elderly care focuses on their roles and interactions with elderly participants [11].

Finally, the challenge of converting unstructured sensor data into structured event logs for analysis is crucial for informed decision-making in elderly care, prompting the survey to explore efficient transformation methods [10]. The implications of efficient computation of counterfactual bounds in structural causal models are also considered, significantly impacting decision-making processes in palliative care [12]. Through these objectives, the survey synthesizes current practices and innovations in palliative and end-of-life care, guiding healthcare service planning and resource allocation.

1.3 Significance of Reviewing Holistic Approaches

Benchmark	Size	Domain	Task Format	Metric
NursingPiles[3]	2,777,526	Nursing	Question Answering	Precision, Recall
ReCAP[14]	6,580	Oncology	Healthcare Utilization Analysis	Risk Ratio, Rate of Healthcare Utilization
PCT-QOD[15]	175	Palliative Care	Quality Assessment	Quality of Dying
PROKARE[16]	52	Dental Care	Service Evaluation	Treatment Outcomes, Attendance Rate
SC-DWS[17]	885	Palliative Care	Self-competence Assessment	SC-DWS, Existential subscale
EOL-DOC[18]	22,640	Palliative Care	Documentation Analysis	Clinical Notes Count, Inter-rater Agreement
BiDAME[19]	45,441	Epidemiology	Death Identification	Sensitivity, Specificity
QODD[20]	1,700	Palliative Care	Quality OF Death Assessment	QODD, CAPA

Table 1: This table presents a comprehensive overview of various benchmarks utilized in healthcare research, highlighting their respective sizes, domains, task formats, and evaluation metrics. The benchmarks span diverse areas such as nursing, oncology, and palliative care, underscoring the multidimensional nature of healthcare studies. These benchmarks serve as critical tools for advancing research in patient care and treatment outcomes.

Evaluating holistic approaches in palliative care is vital for addressing the multifaceted needs of patients with life-limiting illnesses, ensuring comprehensive and patient-centered care. These approaches are particularly crucial in ICU settings, where high mortality rates necessitate quality end-of-life care [4]. By integrating various sensor modalities, holistic care enhances monitoring and support for elderly individuals, creating a responsive and adaptable care environment [21]. This integration is essential for managing confounding factors that arise as patients near the end of life, as evidenced by reverse time-to-death analysis [8]. Table 1 provides a detailed overview of benchmarks used in healthcare research, highlighting their contributions to understanding and improving holistic approaches in palliative care.

Holistic care models also bridge the gap between patients and healthcare providers, addressing mistrust that may lead to treatment refusal [7]. In heart failure management, these approaches ensure that both patients and caregivers receive necessary attention, often overlooked in traditional care models [9]. Treating patients as partners in their care enhances the therapeutic alliance and aligns healthcare organizations with patient values and preferences [6].

The integration of technologies such as socially assistive robots (SAR) and large language models (LLMs) further enriches holistic care by improving social interactions, emotional well-being, and automating event data abstraction from multiple IoT sources. These advancements hold promise for enhancing patient care and health outcomes by leveraging LLMs in nursing [3].

Assessing health-related quality of life (HRQOL) within palliative care frameworks is crucial, as it encompasses psychological and physical symptoms affecting patients' overall well-being [22]. Through these comprehensive strategies, holistic approaches in palliative care can better meet the dynamic needs of patients and their families, ultimately improving the quality of life and death for those facing serious, life-limiting conditions.

1.4 Structure of the Survey

This survey is organized into several key sections to provide a thorough exploration of holistic and compassionate approaches to palliative and end-of-life care for the elderly. The introduction highlights the importance of palliative care in elderly care, the paper's objectives, and the significance of reviewing holistic approaches. Following the introduction, the background and definitions section offers an overview of key terms and discusses the evolution and relevance of these concepts in geriatric assessment and elderly care.

The next section delves into holistic approaches in palliative care, exploring interspecialty collaboration, innovative interventions, patient-centered care, and the role of social support and family involvement. This is followed by an examination of the quality of death and dying, focusing on factors influencing this quality, the role of timely palliative care interventions, and healthcare provider involvement.

Subsequently, the survey addresses geriatric assessment and elderly care, discussing advancements in assessment techniques, the Comprehensive Geriatric Assessment (CGA), and the integration of these assessments into palliative care strategies. The analysis of hospice care and support systems emphasizes the strengths of the hospice model, including its focus on comprehensive communication and emotional support for patients and families. It also introduces the concept of needs rounds, which facilitate collaborative discussions among care teams to address the diverse needs of patients and caregivers, ultimately enhancing end-of-life care quality. This approach mitigates emotional complexities faced by family caregivers and fosters a supportive environment for healthcare staff, improving overall care delivery in hospice settings [23, 24, 25, 26, 27].

The survey concludes with a discussion of challenges and future directions, identifying current challenges in palliative care delivery and proposing strategies for improvement. This section also covers workforce and training challenges, as well as policy and systemic issues. Through this structured approach, the survey aims to provide a detailed examination of current practices and innovations in palliative and end-of-life care, guiding healthcare service planning and resource allocation.The following sections are organized as shown in Figure 1.

2 Background and Definitions

2.1 Key Terms and Concepts

Palliative care is a specialized approach aimed at enhancing the quality of life for patients with serious illnesses by focusing on symptom management and psychosocial support, particularly in advanced conditions like heart failure [8]. Terminal care, a subset, prioritizes comfort over curative treatments for those nearing life's end [4]. End-of-life care (EoLC) extends palliative care's scope to ensure dignity and comfort during the dying process, emphasizing family engagement and communication [7]. Hospice care, integral to EoLC, focuses on quality of life and family involvement, especially for vulnerable populations [7], integrating palliative care's philosophical underpinnings with a comprehensive approach that includes psychological and spiritual dimensions [28].

Patient-centered care (PCC) is fundamental to palliative frameworks, engaging patients as whole individuals and incorporating their emotional and psychological needs into care plans [6]. This ensures healthcare aligns with patients' values, treating them as active partners [6]. The integration of socially assistive robots (SARs) and AI-driven solutions in elderly care highlights the trend of enhancing patient interaction and care delivery through participatory design and stakeholder engagement [11]. Non-contact technologies, such as sensors, are increasingly employed for indoor monitoring, improving the safety and well-being of elderly individuals [21].

Addressing misconceptions and increasing awareness about hospice and palliative care are crucial for enhancing access and utilization among community-dwelling adults [7]. Barriers include inadequate system performance, privacy concerns, and lack of humanlike interaction, which impede effective use of speech-based conversational AI systems [13]. Understanding frailty, a clinical syndrome linked to adverse health outcomes, is vital for comprehensive geriatric assessment and improving elderly care [29]. Through these strategies, palliative care aims to address the dynamic needs of patients and families, enhancing quality of life and death for those with serious, life-limiting conditions.

2.2 Evolution of Palliative and End-of-Life Care

The evolution of palliative and end-of-life care reflects significant changes in both philosophical and practical healthcare aspects. Initially focused on terminal care, palliative care now emphasizes early integration throughout the disease trajectory, recognizing its benefits from diagnosis onward [9]. In developed countries, the evolution of specialist palliative care nursing reflects a shift towards a more medicalized approach, improving outcomes by integrating palliative care into chronic illness management, especially for heart failure. Early palliative care initiation significantly enhances quality of life by enabling timely health deterioration identification, comprehensive needs assessment, and effective symptom management. The World Health Organization advocates for incorporating palliative care from diagnosis for any life-limiting condition, emphasizing equitable care access [30, 26, 31].

Despite advancements, integrating palliative care globally faces challenges, often resulting in inadequate support for life-threatening illnesses. Historical neglect and opioid stigma have hindered effective care delivery [28], necessitating increased awareness and policy reform. Sophisticated methods, such as reverse time-to-death analysis, have improved understanding of time-varying confounding, enhancing care delivery and patient needs assessment [9]. The ongoing evolution of patient-centered care emphasizes comprehensive, patient-focused strategies that cater to diverse needs, fostering partnerships among healthcare providers, patients, and families, aligning care decisions with patient values, leading to improved outcomes and dignified end-of-life experiences [32, 6].

2.3 Relevance to Geriatric Assessment

Geriatric assessment (GA) is crucial for tailoring healthcare strategies to elderly patients' specific needs, ensuring appropriate and effective interventions. In oncology, GA enhances treatment decision-making by providing a holistic understanding of older cancer patients' health status [33]. Integrating GA into clinical practice allows nuanced evaluations of functional status, comorbidities, cognitive function, and social support systems, informing personalized care plans.

Technological advancements have augmented geriatric assessments' efficacy. Non-contact multimodal indoor monitoring systems enable real-time observation of human activities and vital signs, ensuring safety for independently living elderly patients [21]. These systems provide critical data for assessing adverse event risks, enabling timely interventions to prevent health deterioration.

However, integrating technology into geriatric assessments presents challenges. User-centered issues, such as command construction and privacy concerns, alongside technological challenges like speech recognition errors, impact the effectiveness of speech-based systems in elderly care [13]. Addressing these challenges is crucial to enhancing user interaction and ensuring technological solutions are accessible and reliable.

The significance of Comprehensive Geriatric Assessment (CGA) lies in its capacity to evaluate various dimensions of an elderly individual's health—including physical, mental, and social factors—guiding clinical decisions tailored to their specific health status and functional capabilities. This multifaceted approach identifies frailty and associated risk factors, facilitating targeted intervention strategies that enhance care quality for older adults facing complex health challenges [34, 33, 35, 29]. By combining traditional assessment techniques with innovative technologies, healthcare providers can deliver more effective and personalized care, ultimately improving the quality of life for elderly patients.

2.4 Importance in Improving Quality of Life and Death

Palliative and end-of-life care terms are vital for enhancing quality of life and death for individuals with serious, life-limiting conditions. Palliative care positively impacts patient quality of life and provides essential family support during end-of-life, underscoring its significance in holistic healthcare delivery [36]. Real-time monitoring technologies in palliative care settings further improve patient outcomes by enabling proactive issue resolution, enhancing both life and death quality [37].

Nuanced models, such as the semiparametric joint model, deepen understanding of quality of life (QOL) changes as patients approach end-of-life, allowing effective intervention tailoring [38]. Federated survival analysis, exemplified by FedPseudo, highlights the potential for maintaining privacy while enhancing predictive accuracy, contributing to improved patient quality of life [1].

Health-related quality of life (HRQOL) metrics are significant in chronic conditions like breast cancer, offering insights into treatment-related symptoms and their impact on well-being [22]. These metrics are essential for developing comprehensive care strategies addressing multifaceted needs, ultimately improving quality of life and death.

Evidence supporting palliative care's effectiveness in improving outcomes and reducing costs further emphasizes its significance. By addressing interconnected factors rather than isolated issues, palliative strategies enhance quality of life and ensure a dignified dying process. This comprehensive approach is essential for creating compassionate, patient-centered care models that meet individuals' and families' intricate needs, fostering collaboration among healthcare providers, patients, and families. Integrating principles such as empathy, shared decision-making, and holistic care can lead to improved health outcomes, enhanced patient satisfaction, and a more effective healthcare system overall [32, 39, 6, 40, 41].

3 Holistic Approaches in Palliative Care

Holistic approaches in palliative care are essential for addressing the complex needs of patients, particularly the elderly. This section explores the dimensions of holistic care, emphasizing interspecialty collaboration and comprehensive assessments to enhance care quality. As illustrated in Figure 2, the hierarchical structure of holistic approaches in palliative care highlights key categories such as interspecialty collaboration, innovative interventions, patient-centered care, and social support. Each category encompasses subcategories and specific components, which underscore the integration of technology, personalization of care, and the vital role of communication and family involvement in enhancing patient outcomes. By examining collaborative efforts among healthcare professionals, this section provides insights into how diverse expertise can improve patient outcomes.

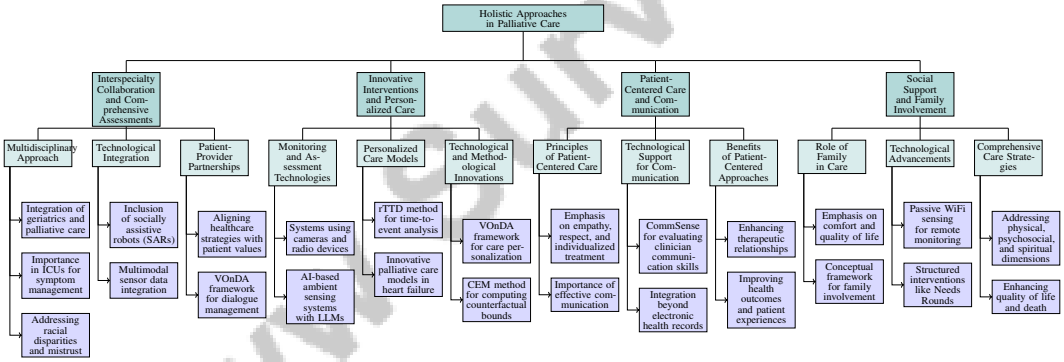


Figure 2: This figure illustrates the hierarchical structure of holistic approaches in palliative care, highlighting key categories such as interspecialty collaboration, innovative interventions, patient-centered care, and social support. Each category includes subcategories and specific components, emphasizing the integration of technology, personalization of care, and the vital role of communication and family involvement in enhancing patient outcomes.

3.1 Interspecialty Collaboration and Comprehensive Assessments

Interspecialty collaboration is fundamental for effective palliative care, facilitating comprehensive assessments that improve patient outcomes. The integration of geriatrics and palliative care underscores the necessity of a multidisciplinary approach to address the complex needs of elderly patients [4]. This collaboration is particularly vital in ICUs, where palliative care integration supports symptom management and holistic patient and family support.

Addressing racial disparities and mistrust in patient-caregiver relationships highlights the need for interprofessional collaboration, as trust metrics derived from clinical notes and interpersonal variables demonstrate [7]. Building a therapeutic alliance ensures comprehensive care that adapts to patient needs [39], especially in heart failure management, where interdisciplinary collaboration is crucial [9].

The inclusion of socially assistive robots (SARs) in healthcare settings exemplifies the need for interdisciplinary collaboration among designers, engineers, ethicists, and healthcare providers to develop effective care solutions [11]. SARs enhance affective therapy, cognitive training, and social interaction, showcasing technology's potential to boost interspecialty collaboration [11]. Multimodal sensor data integration for elderly monitoring further emphasizes collaborative efforts in providing comprehensive care [21].

Patient-provider partnerships are critical in aligning healthcare strategies with patient values and preferences [6]. By combining patient-centered approaches with interspecialty collaboration, healthcare providers can develop holistic care strategies tailored to individual needs [38]. The VOnDA framework integrates rule-based specifications with statistical processes, highlighting the role of collaboration in managing dialogue effectively [42].

As illustrated in Figure 3, the key aspects of interspecialty collaboration in healthcare emphasize multidisciplinary approaches, technological integration, and patient-centered care. This figure highlights the integration of geriatrics and palliative care, the role of socially assistive robots, and the importance of patient-provider partnerships in enhancing healthcare delivery. Interspecialty collaboration is indispensable for delivering holistic palliative care that meets diverse patient and family needs, enhancing quality of life and death for individuals with serious, life-limiting conditions.

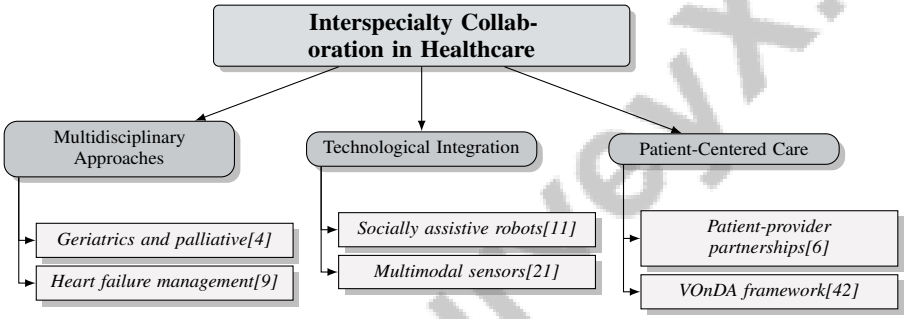


Figure 3: This figure illustrates the key aspects of interspecialty collaboration in healthcare, emphasizing multidisciplinary approaches, technological integration, and patient-centered care. It highlights the integration of geriatrics and palliative care, the role of socially assistive robots, and the importance of patient-provider partnerships in enhancing healthcare delivery.

3.2 Innovative Interventions and Personalized Care

Innovative interventions and personalized care plans are pivotal in advancing palliative care for the elderly, addressing unique challenges and improving outcomes. Systems using cameras and radio devices enhance monitoring accuracy, allowing for precise, responsive interventions [21]. These systems enable real-time assessments, facilitating tailored interventions based on comprehensive data.

The rTTD method aligns time-to-event analysis with time remaining until death, enhancing care personalization [8]. This approach allows accurate predictions of patient needs, ensuring timely care.

AI-based ambient sensing systems integrated with large language models (LLMs) enhance personalized care by providing real-time processing and reasoning capabilities. This innovation improves adaptability and responsiveness of care plans [2]. LLMs can automate event log generation from sensor readings, simplifying data preparation and facilitating personalized care strategies [10].

In heart failure contexts, innovative palliative care models integrating symptom management and caregiver support are essential for addressing patient-specific needs [9]. These models enhance quality of life by focusing on comprehensive strategies encompassing medical and emotional support.

The VOnDA framework enhances dialogue management and user interactions, improving care personalization [42]. The CEM method offers a novel approach to computing counterfactual bounds, providing insights into personalized care interventions [12].

These innovative interventions and personalized care plans are essential for advancing palliative care practices. By leveraging technological advancements and promoting interdisciplinary collaboration,

providers can create tailored strategies that effectively address the multifaceted needs of elderly patients, enhancing their quality of life [3, 34, 27, 24].

3.3 Patient-Centered Care and Communication

Patient-centered care is fundamental to palliative care, emphasizing empathy, respect, and individualized treatment plans that align with patient values [5]. This approach is crucial in elderly care, where effective communication addresses complex patient needs [6]. Patient-centered communication fosters collaborative interactions, enhancing therapeutic alliances and comprehensive care [5].

Effective communication facilitates the exchange of critical information, ensuring patients and families are informed about care decisions. Technologies like CommSense offer scalable methods for evaluating clinician communication skills, promoting continual improvement [43]. By prioritizing open dialogue and active listening, healthcare providers address emotional and psychological care dimensions, enhancing patient satisfaction [5].

Integrating patient-centered strategies underscores ongoing engagement, team collaboration, and communication beyond electronic health records for successful care planning [41]. This holistic approach ensures care strategies are tailored to individual needs, improving quality of life and care experiences for elderly patients.

Patient-centered care and effective communication are essential for delivering compassionate, comprehensive palliative care. By engaging in open dialogue and prioritizing patient values, healthcare providers create responsive strategies while upholding patient autonomy. This collaborative approach fosters therapeutic relationships, enhances communication, and leads to improved health outcomes and patient experiences. Treating patients as partners in their care leads to better safety, quality, and financial stability in healthcare organizations [32, 5, 6, 41].

3.4 Social Support and Family Involvement

Social support and family involvement are integral to holistic palliative care, ensuring patients' multifaceted needs are met comprehensively. Hospice care values family roles in the care process, emphasizing comfort and quality of life [44]. This approach prioritizes patient well-being and acknowledges family contributions to emotional and practical support.

A conceptual framework categorizes existing research, highlighting the importance of creating a patient-centered environment that involves family members in end-of-life care [24]. Such frameworks facilitate care strategies that recognize unique family dynamics, ensuring interventions support both patients and caregivers. Caregiver well-being is critical, with interventions informed by understanding the quality of dying experiences, enhancing resilience [45].

Meticulous documentation of patient well-being enhances social support and family involvement, serving as a benchmark for comprehensive care [18]. This process enables providers to address emotional, psychological, and social care dimensions, fostering a supportive environment.

Technological advancements like passive WiFi sensing enable remote health monitoring, allowing family members to remain involved without physical presence [46]. This innovation enhances care by providing continuous monitoring, promoting security and involvement.

Structured interventions like Needs Rounds improve the quality of death and dying by systematically addressing patient and family needs [20]. These interventions ensure care is proactive and adaptive, aligning with palliative care nursing's philosophical foundations to enhance overall care quality [28].

Integrating social support and family involvement is crucial for delivering holistic palliative care, addressing patients' needs through a multidisciplinary approach encompassing physical, psychosocial, and spiritual dimensions [47, 27]. By fostering a collaborative and supportive care environment, providers enhance the quality of life and death for individuals with serious conditions, ensuring compassionate and comprehensive care.

4 Quality of Death and Dying

4.1 Factors Influencing Quality of Death and Dying

The quality of death and dying is shaped by a multifaceted interplay of medical, psychological, and social factors. Figure 4 illustrates these factors, categorizing them into distinct domains, including the integration of palliative care, effective communication, societal stigma, and the role of technology. Notably, the figure emphasizes how technologies such as socially assistive robots and LLM-based data processing contribute to enhancing end-of-life care.

Integrating palliative care significantly enhances symptom management and patient satisfaction, particularly in ICU settings where specialist involvement is crucial [4]. However, disparities in palliative care practices and a global shortage of trained professionals impede the consistent delivery of high-quality end-of-life care [36]. Technologies like non-contact multimodal indoor monitoring are vital for timely interventions through real-time health data, improving the dying process for elderly patients with complex conditions such as heart failure [21, 9].

Effective communication is critical, as mistrust between patients and clinicians can lead to suboptimal decisions, underscoring the need for transparent, empathetic dialogue [7]. Societal stigma and misalignment between patient goals and healthcare objectives further complicate treatment engagement [39]. Overcoming these barriers is essential for building trust and aligning care with patient preferences.

The use of socially assistive robots (SARs) highlights technology's potential to enhance emotional well-being and social interactions [11]. However, the medicalization of palliative care can overshadow its holistic nature, neglecting emotional and spiritual needs [28]. Balancing technological advancements with compassionate care is crucial for addressing the psychological and emotional dimensions of dying.

Automation in data processing, such as LLM-based event abstraction, improves data analysis and care delivery by reducing the need for domain expertise [10]. Addressing these factors enables healthcare providers to develop comprehensive strategies that enhance the quality of death and dying, ensuring end-of-life care remains compassionate and effective.

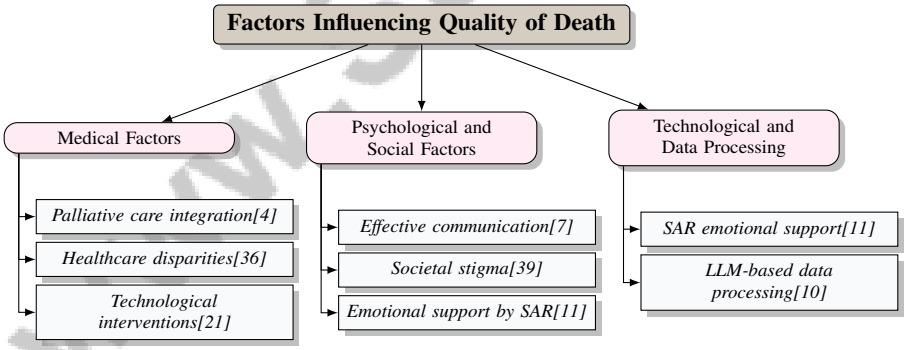


Figure 4: This figure illustrates the factors influencing the quality of death and dying, categorized into medical, psychological, social, and technological aspects. It highlights the integration of palliative care, effective communication, societal stigma, and the role of technology, such as socially assistive robots and LLM-based data processing, in enhancing end-of-life care.

4.2 Role of Timely Palliative Care Interventions

Timely palliative care interventions are essential for optimizing end-of-life experiences, improving symptom management, and aligning care with patient goals. Predictive frameworks like the EMCC algorithm enhance counterfactual reasoning accuracy, improving care quality by anticipating patient needs [12]. In ICU settings, early palliative care integration correlates with improved end-of-life experiences and reduced hospital stays, highlighting the importance of timely interventions [4]. For advanced heart failure patients, these interventions address medical and emotional needs, enhancing quality of life and death [9].

Effective communication is integral to these interventions, correlating with improved patient satisfaction and outcomes, thus necessitating the removal of communication barriers [5]. Technological advancements, such as AI-based ambient sensing systems, enable real-time monitoring essential for timely interventions [2]. LLMs in nursing and elderly care support AI-driven solutions, showcasing the potential of timely interventions to improve outcomes [3]. Methods like reverse time-to-death (rTTD) analysis provide accurate health outcome assessments, enabling personalized care strategies [8].

Incorporating timely palliative care interventions is vital for compassionate, patient-centered care, enhancing life quality for seriously ill patients and improving end-of-life experiences. Systematic identification and referral of patients with high supportive care needs ensure personalized care is promptly provided, supported by standardized criteria and effective communication, leading to greater satisfaction and reduced distress [40, 48]. Early integration and innovative approaches enable comprehensive care strategies that meet diverse needs of individuals with life-limiting conditions.

4.3 Healthcare Provider Involvement

Healthcare providers play a pivotal role in ensuring dignified end-of-life care, addressing complex patient and family needs. Palliative care team consultations in hospitals enhance the quality of dying, emphasizing specialized care's importance in improving outcomes [15]. These consultations facilitate comprehensive care planning, symptom management, and emotional support, aligning care with patient preferences and enhancing the end-of-life experience.

Providers face challenges such as emotional exhaustion, symptom management difficulties, and complex family communications [25]. The emotional toll of grief on staff underscores the need for support systems addressing the psychological impact of end-of-life care. Adequate training and resources empower providers to navigate these challenges, ensuring compassionate, patient-centered care.

Effective communication among providers, patients, and families is essential for building trust and aligning care with patient values and goals. This communication is a core component of patient-centered care, emphasizing active engagement with patients and families to understand preferences and needs. Overcoming communication barriers and fostering collaborative relationships enhance care quality, promote positive outcomes, and ensure patients feel respected throughout their healthcare journey [32, 5, 6, 40, 27]. Addressing these barriers significantly improves end-of-life care quality, enabling respectful, responsive care.

Active healthcare provider participation is essential for dignified end-of-life care, fostering compassionate collaboration that enhances satisfaction, communication, and shared decision-making, leading to a higher quality of dying experience [15, 40, 24, 36]. Prioritizing comprehensive care strategies, effective communication, and support for professionals significantly enhances the quality of life and death for patients with serious, life-limiting conditions.

5 Geriatric Assessment and Elderly Care

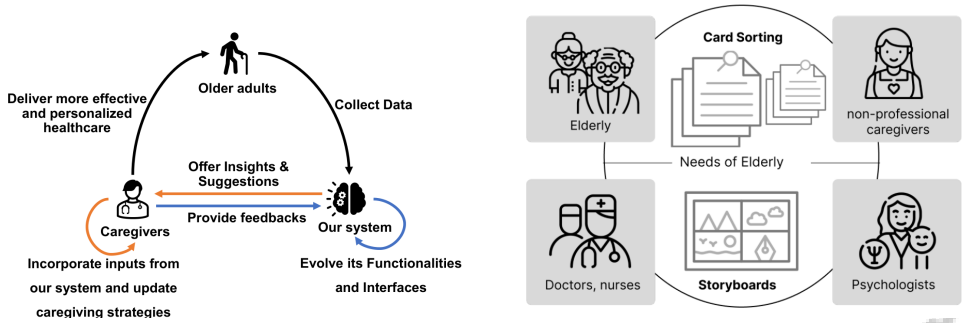
5.1 Advancements in Geriatric Assessment Techniques

Recent advancements in geriatric assessment techniques have significantly enhanced healthcare strategies for elderly patients, particularly those with advanced illnesses like cancer. Evaluations of geriatric assessment (GA) interventions reveal a reduction in serious treatment-related toxicity, improving overall treatment outcomes and quality of life for older patients [49]. This underscores the necessity of comprehensive assessment strategies that address the unique vulnerabilities of this demographic.

Innovative models such as the Fast Preceding Questionnaire Model (FPQM) streamline the assessment process by calculating attribute influences, thereby optimizing questionnaire efficiency and effectiveness [50]. These models facilitate the rapid identification of critical health indicators, enabling healthcare providers to develop personalized care plans.

Despite these advancements, operationalizing patient-centered care across diverse healthcare settings remains challenging [32]. Addressing these gaps is crucial for ensuring geriatric assessment

techniques are comprehensive and adaptable. By refining methodologies and integrating innovative approaches, healthcare providers can enhance care quality and health outcomes for elderly patients.



(a) Integrating Caregivers' Insights into Healthcare for Older Adults[51]

(b) Card Sorting and Storyboards in Elderly Care[52]

Figure 5: Examples of Advancements in Geriatric Assessment Techniques

As illustrated in Figure 5, significant advancements in geriatric assessment techniques enhance healthcare delivery for older adults. The example "Integrating Caregivers' Insights into Healthcare for Older Adults" demonstrates a dynamic interaction cycle among caregivers, older adults, and the healthcare system, fostering a feedback loop that continuously evolves healthcare functionalities. The "Card Sorting and Storyboards in Elderly Care" example showcases participatory design techniques involving various stakeholders, including elderly individuals, in shaping caregiving processes, emphasizing the integration of diverse perspectives in developing effective, personalized care strategies [51, 52].

5.2 Comprehensive Geriatric Assessment (CGA)

The Comprehensive Geriatric Assessment (CGA) is a multidimensional diagnostic process evaluating the medical, psychosocial, and functional capabilities of elderly patients to create a coordinated treatment and long-term follow-up plan [34]. This assessment is essential for individuals aged 65 and above, encompassing cognitive, mood, functional status, and nutritional evaluations crucial for addressing the complex needs of this demographic [35]. The CGA is instrumental in identifying frailty, facilitating targeted interventions to mitigate adverse outcomes [29].

Implementing CGA in geriatric outpatient services allows healthcare providers to systematically address the multifaceted challenges faced by older adults, ensuring care is comprehensive and tailored to individual needs [35]. By integrating assessments of physical health, mental health, and social circumstances, the CGA provides a holistic view of an elderly patient's well-being, enabling personalized care plans that optimize health outcomes [34].

In addressing frailty, the CGA enhances elderly patients' resilience, reducing susceptibility to adverse health events, which is particularly important in managing chronic illnesses and preventing functional decline. The CGA promotes early detection of potential health issues and proactive management strategies [34]. Ultimately, the CGA serves as a vital tool in geriatric care, offering a structured approach to evaluating and addressing the diverse needs of elderly patients, thereby improving their quality of life and healthcare experiences.

5.3 Integration of Geriatric Assessment in Palliative Care

Integrating geriatric assessment (GA) into palliative care strategies is crucial for optimizing care delivery to elderly patients with complex, life-limiting conditions. GA provides a comprehensive evaluation of an elderly patient's medical, psychosocial, and functional capabilities, essential for developing individualized care plans that enhance treatment outcomes and quality of life. Incorporating frailty assessments into palliative care allows healthcare providers to tailor interventions based on the Comprehensive Geriatric Assessment (CGA) [29].

In palliative care, GA facilitates informed decision-making, aligning care approaches with patient goals and preferences. Advanced assessment techniques, such as the semiparametric joint model,

improve understanding of patient outcomes by controlling for confounding factors, allowing for more accurate predictions and interventions [38]. Additionally, predictive model monitoring methods like the BayesWatch Bayesian Change Point method enhance geriatric assessments' effectiveness, ensuring timely and relevant care decisions [37].

The integration of geriatric assessment in palliative care is visually represented in Figure 6, which illustrates key assessment techniques, care models, and technological integrations that enhance patient-centered care for elderly individuals with complex conditions. This figure emphasizes the importance of ongoing clinician training to ensure effective utilization of GA in care planning, highlighting a cultural shift that prioritizes patient goals and improves team communication to incorporate personalized care planning into existing clinical workflows [41]. Utilizing patient-centered care models, such as the PC4 Model, enhances nurse-patient interactions, leading to improved patient-centered care [5].

Technological advancements, including AI-based ambient sensing systems (AI-ASS), further augment palliative care strategies by enabling better recognition of elderly individuals' complex activities and needs. This integration fosters more responsive and adaptable care environments, enhancing the overall care experience [2]. Moreover, the incorporation of wearable technology and natural language processing, as demonstrated by CommSense technology, improves patient-provider communication in palliative care settings, thereby enhancing care quality [43].

In managing chronic conditions like heart failure, integrating comprehensive geriatric assessments into palliative care is essential for enhancing care quality. By promoting interdisciplinary teamwork and family involvement in decision-making, healthcare providers can ensure comprehensive palliative care strategies aligned with patient values and goals. This approach fosters partnerships among healthcare practitioners, patients, and families, enhancing patient outcomes through compassionate care tailored to individual needs, ultimately leading to improved satisfaction, reduced staff burnout, and stronger healthcare organizations [32, 40, 6].

The integration of geriatric assessment into palliative care is crucial for delivering patient-centered care that meets the diverse needs of elderly individuals. By utilizing comprehensive geriatric assessments, advanced evaluation methodologies, and fostering interdisciplinary collaboration, providers can formulate targeted care strategies that significantly improve the quality of life and care experiences for elderly patients facing serious, life-limiting conditions. This approach addresses the complex needs of these patients and enhances their end-of-life care, as evidenced by studies on structured dementia care management programs and family caregiver perspectives in nursing home settings [53, 34, 24].

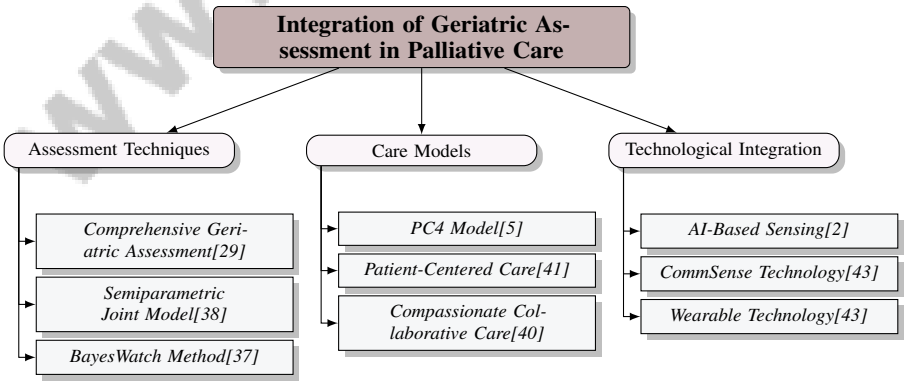


Figure 6: This figure illustrates the integration of geriatric assessment in palliative care, highlighting key assessment techniques, care models, and technological integrations that enhance patient-centered care for elderly individuals with complex conditions.

6 Hospice Care and Support Systems

6.1 Strengths of the Hospice Model

The hospice care model, emphasizing patient-centered care, prioritizes comfort, dignity, and quality of life for individuals nearing the end of life. Its holistic approach integrates medical, emotional, and spiritual support, addressing the unique needs of patients and their families [4]. This model not only focuses on symptom management but also enhances overall well-being during life's final stages. Figure 7 illustrates the strengths of the hospice model, emphasizing its holistic approach, interdisciplinary teamwork, and adaptability. The model focuses on patient-centered care, symptom management, and emotional support, ensuring coordinated care and family involvement. Its flexibility in various settings aligns care with patient preferences, enhancing quality of life.

A significant strength of hospice care is its interdisciplinary teamwork, involving healthcare professionals like doctors, nurses, social workers, and chaplains to address patients' multifaceted needs [44]. This collaborative approach ensures coordinated care planning, effectively managing all aspects of a patient's condition. Additionally, family involvement is encouraged, enabling active participation in the care process and providing necessary support for coping with end-of-life emotional challenges [24].

Hospice care's adaptability to various settings, such as home, hospice facilities, or hospitals, further highlights its strengths. This flexibility ensures consistent, continuous care aligned with patient preferences, crucial for maintaining dignity and quality of life in their final days [28]. Furthermore, hospice care excels in addressing psychological and spiritual dimensions, recognizing the importance of emotional support for both patients and their families [45]. By fostering open communication and addressing existential concerns, hospice care helps patients find meaning and peace as they approach the end of life.

The strengths of the hospice model stem from its holistic, interdisciplinary, and adaptable approach, addressing patients' physical, emotional, and spiritual needs while involving families in the care process. This comprehensive support framework enhances quality of life, fosters effective communication, shared decision-making, and goal setting, leading to higher satisfaction levels among patients and families, improved teamwork among healthcare providers, and reduced staff burnout. The model emphasizes compassion and collaboration, aligning care with the values and expectations of those it serves [40, 24].

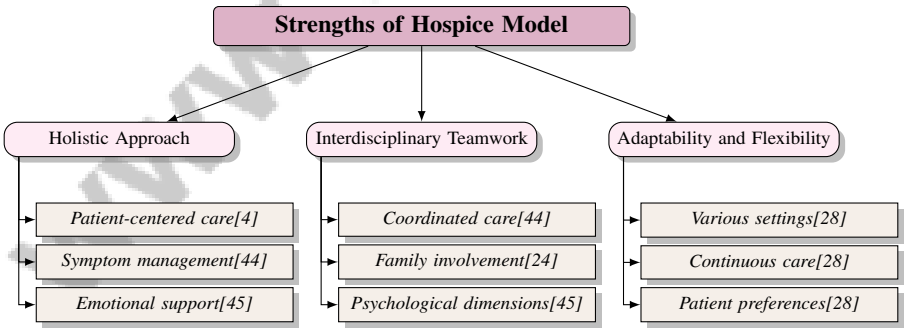


Figure 7: This figure illustrates the strengths of the hospice model, emphasizing its holistic approach, interdisciplinary teamwork, and adaptability. The model focuses on patient-centered care, symptom management, and emotional support, ensuring coordinated care and family involvement. Its flexibility in various settings aligns care with patient preferences, enhancing quality of life.

6.2 Communication and Emotional Support

Communication and emotional support are pivotal in hospice care, significantly influencing the quality of life for patients and their families at the end of life. Effective communication fosters trust and collaboration among healthcare providers, patients, and families [5], ensuring care aligns with patient preferences and values, facilitating informed decision-making, and enhancing satisfaction [6].

Innovative tools, such as wearable sensing technologies and computational methods, provide objective insights into clinician communication skills, enabling continuous improvement in patient-provider interactions [43]. These advancements support the creation of personalized care plans addressing each patient's unique needs, ensuring compassionate and effective care delivery.

Emotional support is equally vital, addressing the psychological dimensions of end-of-life experiences. By creating an environment acknowledging and validating patients' and families' emotional experiences, hospice care teams enhance overall well-being [45]. Including family members in the care process strengthens emotional support networks, providing caregivers with resources and guidance for navigating end-of-life challenges [24].

The hospice model emphasizes addressing existential concerns and fostering peace and meaning for patients as they approach the end of life. By prioritizing effective communication and emotional support, hospice care teams create a compassionate environment honoring patient and family dignity and preferences, ultimately enhancing satisfaction and contributing to higher quality end-of-life care. This approach aligns with findings highlighting the critical role of patient and family-centered care, shared decision-making, and collaborative practices in achieving optimal outcomes in palliative settings [24, 25, 40, 47, 15]. Through these efforts, hospice care improves patient quality of life while providing essential family support.

6.3 Needs Rounds in Hospice Care

Needs rounds in hospice care represent a structured approach to identifying and addressing patients' and families' specific needs, enhancing end-of-life care quality. This concept involves regular interdisciplinary team meetings where healthcare professionals collaboratively assess and prioritize patient needs, ensuring care is tailored to individual circumstances and preferences [20]. Needs rounds facilitate proactive care planning, enabling teams to anticipate potential issues and implement timely interventions that improve patient outcomes and satisfaction.

Implementing needs rounds underscores the importance of a holistic approach, where physical, emotional, and spiritual needs are comprehensively considered. By fostering open communication and collaboration among team members, needs rounds help ensure that all aspects of a patient's condition are addressed, reducing the likelihood of unmet needs and enhancing the overall care experience [28]. This approach benefits patients and supports family members in navigating end-of-life emotional complexities.

Moreover, needs rounds contribute to the continuous improvement of hospice care by facilitating knowledge exchange among healthcare professionals. Through regular discussions and evaluations, teams can identify best practices and areas for improvement, ultimately enhancing the quality of care provided to patients and families. Incorporating needs rounds into hospice care exemplifies a commitment to patient-centered care by actively addressing the diverse and evolving requirements of individuals with serious, life-limiting conditions. This approach emphasizes empathy, communication, and shared decision-making, aligning with overarching values identified in the literature, such as respect and partnership. By systematically integrating these principles, hospice services can enhance patient and family satisfaction, improve teamwork among healthcare providers, and contribute to higher quality end-of-life care [32, 40].

7 Challenges and Future Directions

7.1 Challenges and Strategies for Improvement

Palliative care faces challenges that hinder its optimization and accessibility, necessitating strategies for improvement. A key issue is the focus on provider needs over patient-centered approaches, demanding a shift to prioritize patient preferences [6]. The complexity of comprehensive geriatric assessments and the absence of standardized frailty measures further complicate care delivery [29]. In intensive care, inadequate training among clinicians and logistical challenges in patient selection are significant barriers [4], requiring educational frameworks that emphasize holistic care [28]. Variability in methodological quality and the absence of standardized measures impede the evaluation of health-related quality of life (HRQOL) [22].

Privacy concerns related to monitoring technologies and the need for reliable performance under varying conditions complicate care delivery [21]. Innovative solutions, such as AI-based ambient sensing systems, can enhance monitoring and assistance, underscoring the need for continuous innovation [2]. Methods like reverse time-to-death (rTTD) analysis can address challenges related to controlling time-varying confounding, improving health outcome assessments [8].

Manual event preparation methods can be streamlined through LLM-based event abstraction techniques, enhancing data processing and decision-making [10]. Methodological issues in research on socially assistive robot (SAR) technology, such as small sample sizes, highlight the need for robust research designs [11]. Challenges in palliative care for heart failure include limited research funding and insufficient evidence on effective care models [9], necessitating increased investment and development of evidence-based models. Understanding diverse backgrounds and technological experiences is crucial for inclusive design [13].

The reliance on rule-based specifications in frameworks like VOnDA limits adaptability, requiring extensive development compared to statistical systems [42]. Challenges in causal inference methods, which are NP-hard, require improvement strategies through algorithms such as EMCC [12]. Addressing these challenges requires a multifaceted approach integrating technological innovations, comprehensive training, and strategic resource management. Implementing strategies to overcome barriers, such as clinician training deficits, limited public awareness, and insufficient policy support, can enhance palliative care services, facilitating timely referrals and improving health-related quality of life outcomes [54, 55, 48].

7.2 Workforce and Training Challenges

Workforce training and development are crucial for addressing the complexities of palliative care, especially for life-limiting conditions like heart failure. Current training programs often lack standardization, compromising care quality [9]. Comprehensive curricula incorporating patient-centered care (PCC) and interprofessional collaboration (IPC) are essential [29]. Integrating the Comprehensive Geriatric Assessment (CGA) into training is vital for managing frailty in elderly patients [29]. The incorporation of socially assistive robots (SARs) presents additional training challenges, requiring caregivers to effectively utilize these technologies [11].

Challenges associated with advanced monitoring systems underscore the need for training in understanding and utilizing these technologies. Ensuring healthcare providers are proficient in multimodal monitoring systems is crucial for improving outcomes [21]. Addressing workforce and training challenges enhances palliative care quality. Promoting interdisciplinary collaboration, establishing standardized training programs, and incorporating innovative assessment tools enable healthcare providers to tackle barriers effectively. This approach enhances communication and shared decision-making, leading to improved satisfaction, reduced staff burnout, and better health outcomes [32, 56, 40]. Future research should validate these methods in clinical settings and explore ethical implications of using large language models (LLMs) in communication.

7.3 Policy and Systemic Challenges

Policy-level challenges and systemic barriers significantly impact palliative care delivery, necessitating comprehensive strategies. Integrating technologies like passive WiFi sensing into palliative care frameworks requires adaptation within established systems to enhance elderly care [46]. Deploying socially assistive robots (SARs) necessitates research into user experiences and cost-reduction strategies, highlighting the need for robust policy frameworks for ethical integration.

The FedPseudo model's decentralized data analysis approach emphasizes policy frameworks supporting such methods, ensuring data privacy and enhancing care delivery [1]. Systemic barriers, including racial disparities and mistrust, underscore the need for interdisciplinary collaborations to improve trust and treatment decisions [7]. Future research should stratify challenges by factors like technological experience and cognitive functioning to tailor AI solutions for elderly care [13]. Exploring broader applications of benchmarks across languages and cultures, along with enhancing multimodal capabilities, can contribute to more inclusive and effective strategies [3].

Engaging patients in co-designing care and implementing systemic changes are critical policy challenges, emphasizing patient-centered approaches that prioritize preferences and needs [6]. Addressing

these challenges enables healthcare systems to develop effective and equitable strategies, improving outcomes for patients and families.

8 Conclusion

Holistic approaches in palliative care are crucial for enhancing the quality of life and symptom management among elderly populations. The integration of interdisciplinary care models and advanced technologies, such as IoT and large language models, has significantly improved care delivery, offering substantial benefits in addressing health-related quality of life. Despite these advancements, there remain critical gaps in evidence, particularly concerning the integration of palliative care in heart failure management, highlighting the need for continued innovation and targeted research.

The projected increase in demand for palliative care calls for systemic changes within healthcare systems to ensure they can meet these needs effectively. Developing comprehensive policies that ensure equitable access to palliative care and utilize technology to enhance communication and service delivery is imperative. In ICU settings, early palliative care assessments, guided by standardized protocols, are essential for ensuring effective care delivery.

Future research should focus on developing predictive algorithms for workload analysis and optimizing resource allocation strategies. Enhancing the therapeutic alliance and facilitating shared decision-making are vital for improving treatment engagement across various healthcare settings. Additionally, leveraging electronic health records to develop predictive models can enhance patient prioritization and improve the quality of end-of-life care.

The potential of large language models to enhance efficiency and accuracy in generating event logs from IoT data underscores the importance of sustained research and innovation in holistic palliative care approaches. The efficiency of algorithms like EMCC in computing counterfactual bounds suggests promising applications in refining palliative care practices.

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