

Issue Brief 22

State of the Science and Future Directions To Improve Diagnostic Safety in Older Adults



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State of the Science and Future Directions To Improve Diagnostic Safety in Older Adults

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Introduction

Between 2010 and 2020, the population of adults over the age of 65 saw the largest and fastest growth in any decade and reached 55.8 million, or 16.8 percent of the total U.S. population.¹ Further, the number of older Americans is projected to nearly double by 2060,² with those age 85 and older expected to nearly quadruple between 2000 and 2040; many of these people have multiple chronic conditions (MCCs) and complex health and social needs.³

To ensure effective treatments and improved health outcomes among older adults, it is essential to understand and address the unique challenges of accurate and timely diagnosis for this group. Misdiagnosis or delayed diagnosis is a public health challenge and is estimated to affect at least 1 in 20 U.S. adults, with the potential to lead to severe harm in about 6 million outpatients per year.⁴ It can lead to inappropriate treatments, disease progression, preventable hospitalizations, and other adverse outcomes.

Older adults are at higher risk for diagnostic errors than younger adult populations for multiple reasons, including:

- Multiple coexisting conditions,
- Atypical presentations of common diseases,
- Stereotypes about aging (i.e., attributing symptoms warranting evaluation to aging),
- Complications from medications, and
- Communication barriers due to cognitive or sensory impairments.^{5,6}

Comorbidities and multiple medications (i.e., polypharmacy) can mask or mimic symptoms of other diseases, ultimately leading to misdiagnosis or delayed diagnosis. For many diseases, older adults may present atypically, thus contributing to additional difficulties for clinicians to make timely and accurate diagnoses.

Common geriatric syndromes such as frailty, dementia, delirium, falls, and incontinence may complicate the diagnostic process by making it difficult to distinguish new acute problems from exacerbations of chronic symptoms of existing diseases. At times, these problems go undiagnosed. Furthermore, health-related social needs and other social factors can present barriers to accessing timely services and diagnostic testing.

This issue brief presents the unique considerations and challenges of studying and improving diagnostic safety for older adults. A number of recent expert workgroups have identified key areas of focus for diagnostic safety research and improvement efforts.⁶⁻⁹ However, few efforts exist to summarize existing literature focused on understanding and addressing diagnostic errors in older adult populations, particularly with the objective of identifying opportunities for improvement. We summarize the state of the science around the diagnostic process in older adults, focusing on unique challenges, followed by selected recommendations for practice improvement, research, and policy to reduce the risk of diagnostic error.

Unique Challenges in Approaching Diagnostic Safety in Older Adults

Definitions of older adults can vary, but usually, they are described as people with a chronological age of 65 years or older.^{10,11} Several studies have found increasing age to be a significant predictor of missed diagnoses. For example, one 2018 chart review study examining patients with hepatocellular carcinoma (HCC) found the strongest predictor of missed diagnosis of cirrhosis (a leading risk factor for HCC) to be age, which was associated with larger tumor sizes at HCC diagnosis and implied worse prognosis.¹² Similarly, increasing age has been found to be associated with poorer diagnostic accuracy of heart failure, with older patients being less likely to receive echocardiograms.^{5,13}

Several studies have also suggested a correlation between older age and missed diagnoses of respiratory conditions, including tuberculosis¹⁴⁻¹⁶ and asthma^{17,18}; cancers^{19,20}; mental health conditions such as depression²¹⁻²³; and diabetes-related complications.²⁴ A 2016 systematic review of the incidence and potential causes of diagnostic errors in older adults looked at seven prevalent diseases:

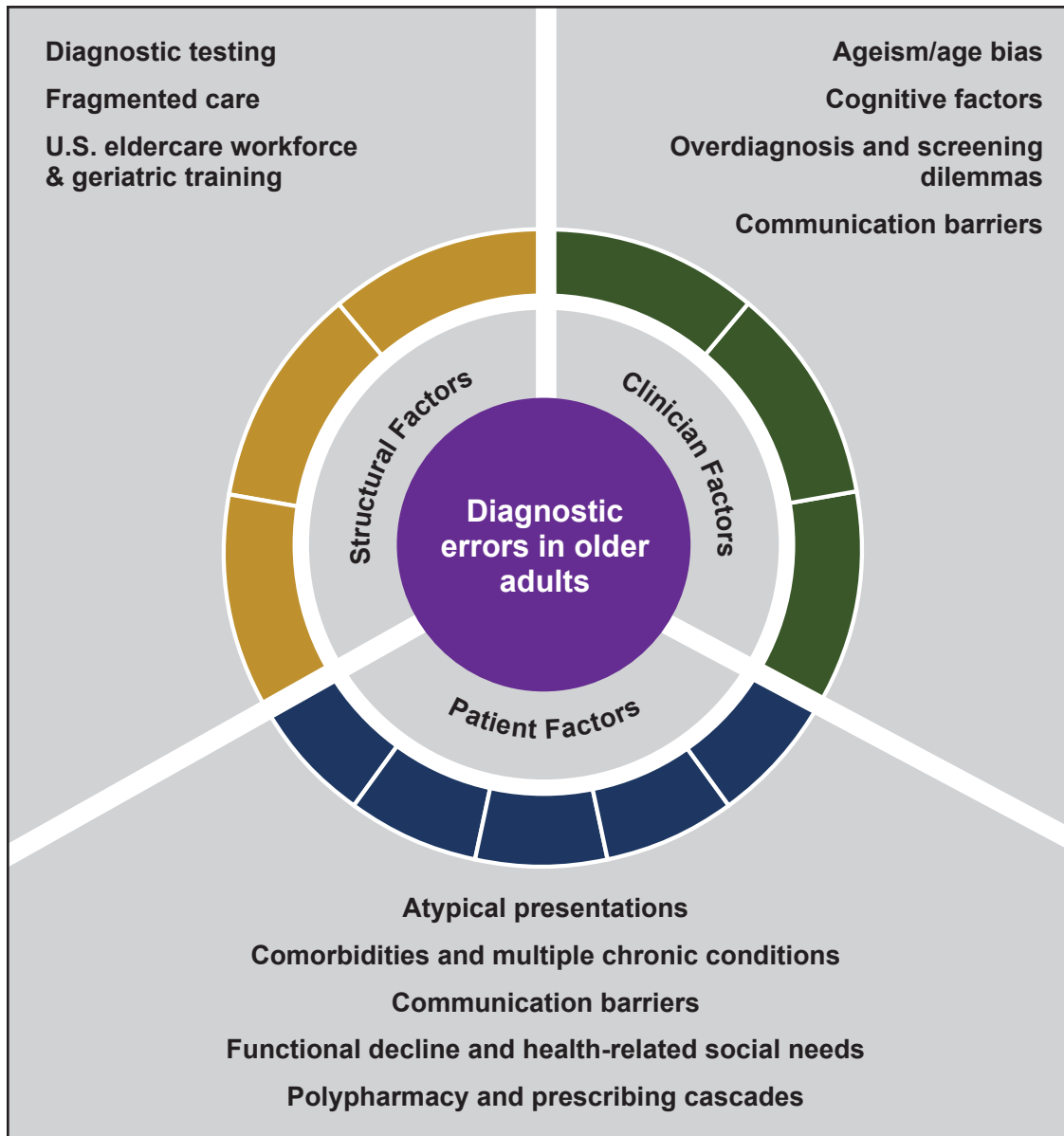
- Dementia,
- Chronic obstructive pulmonary disease,
- Heart failure,
- Parkinson's disease,
- Stroke/transient ischemic attack,
- Acute myocardial infarction, and
- Diabetes.

Researchers found that increasing age was often associated with lower diagnostic accuracy and resulted in both overdiagnosis and underdiagnosis of these common conditions.⁵

Older adults are a highly heterogeneous group who experience very different trajectories of age-related changes across the life course. These changes reflect cumulative disadvantages that occur throughout an individual's life, requiring consideration of physiologic age in the diagnostic process.²⁵⁻²⁸ The unique characteristics and risk factors of individual patients are important for diagnosticians and care teams to consider throughout the diagnostic process and in making decisions to support older adults' health.

In the following subsections, we present several challenges in approaching diagnostic safety that are unique to older adults. We divide these into patient, clinician, and structural factors (Figure 1).

Figure 1. Patient, clinician, and structural factors contributing to diagnostic errors in older adults



Patient factors

Atypical presentations. Older adults have more atypical presentations of medical conditions compared with their younger adult counterparts, and clinicians face many challenges in assessing and treating older patients for common diseases and conditions. For example, diagnosis of sepsis in older adults can be especially challenging and sepsis is often underdiagnosed, as older adults with sepsis often present with atypical, nonspecific symptoms.²⁹⁻³¹ The most common example is the presence of altered mental status, but other examples of symptoms of infection in older adults include lethargy, tachypnea, loss of appetite, dehydration, weakness, dizziness, falls, and incontinence.²⁹⁻³¹

Similarly, a 2023 scoping review aimed at identifying the atypical presentation of symptoms of COVID-19 in older adults identified 58 atypical symptoms that were reported in the literature. Geriatric syndromes (e.g., delirium, falls, reduced/loss of appetite or anorexia, or functional impairment) were the most prevalent atypical presentation.³²

Differences in diagnoses of certain mental health conditions, such as borderline personality disorder (BPD), have also been noted between younger and older patients. In older patients with BPD, studies have found that symptoms shift to more depression, emptiness, and somatic complaints,³³ with self-harm taking nonconventional forms such as nonadherence to medical regimes or misuse of medication.³⁴

In a retrospective review of older adult patient cases in an emergency department (ED) of a tertiary care hospital in Thailand, researchers found that the prevalence of an atypical presentation was 28.6 percent of 633 older adult patients. Independent risk factors associated with atypical presentations were complicated urinary tract infection (UTI) and a history of dementia, with the absence of a fever with a disease known to cause fever as the most common atypical presentation.³⁵

Several individual case reports describe atypical presentations of patients, challenges in diagnoses, and “hard-to-diagnose” conditions in the scientific literature. Table 1 provides examples of case reports in the medical literature that were published in the last 10 years and describe diagnostic errors of common conditions and health concerns in patients over age 50, with implications for the older adult population.

Table 1. Examples of case reports with diagnostic errors of common health concerns in older adults

Authors	Title	Description/ Summary
Barrett and Hoover (2023) ³⁶	Differential screen and treatment of vestibular dysfunction in an elderly patient: a case report	A 72-year-old male presented to his physical therapist 23 days after falling off a ladder, resulting in a mild traumatic brain injury. He was initially diagnosed with a labyrinthine concussion due to ongoing symptoms of "falling backwards," poor gait, and diminished mobility. A physical therapy examination later revealed atypical benign paroxysmal positional vertigo, highlighting the importance of thorough medical screening and differential diagnosis for all conditions, regardless of referral source.
Cosme, et al. (2023) ³⁷	Newly diagnosed Type 1 diabetes in an elderly patient	A 71-year-old patient presented to the ED with polyuria, polydipsia, and tiredness. She was identified with hyperglycemia and high blood and urine ketone bodies. Further laboratory workup showed she was positive for anti-GAD and anti-ICA antibodies and her HbA1c was 14.1 percent. Because the patient's symptoms were associated with metabolic ketoacidosis in the presence of high titers of more than one positive type 1 diabetes (T1D)-related antibody, a diagnosis of T1D was achieved. Recognition of adult-onset T1D is important, as a prompt diagnosis can avoid misdiagnosis of type 2 diabetes. GAD=glutamic acid decarboxylase; ICA=islet cell antibodies;HbA1c=hemoglobin A1c
Guibentif, et al. (2016) ³⁸	Acute appendicitis in elderly adults: a difficult diagnosis	Appendicitis may present with unspecific symptoms of infection in older adult patients. Patient A (83 years old) had underlying cognitive impairment and acutely altered mental status, with delayed abdominal complaint; Patient B (87 years old) had acute appendicitis with initial nonspecific signs of infection: fever and leukocytosis. Patient B developed an acute abdomen, delaying diagnosis by 8 days. Older adults typically have more comorbidities and greater frailty, where appendicitis may present with nonspecific symptoms of infection.
Lamjoun, et al. (2023) ³⁹	Normal pressure hydrocephalus and mania symptoms: case report	A 54-year-old male presented with psychiatric symptoms suggestive of a manic episode but left the hospital against medical advice before needed tests could be performed. In the patient's second admission, symptoms worsened and included urinary incontinence and gait disorder. MRI showed a quadric ventricular hydrocephalus and the patient was diagnosed with idiopathic cerebral hydrocephalus, requiring neurosurgery. This case exemplifies the importance of considering organic causes of psychiatric symptoms in older people.
Hoyt and Jordan (2023) ⁴⁰	The diagnostic challenge of an older adult with epigastric pain in the emergency department	Epigastric pain is a common complaint in patients presenting to the ED. A 70-year-old man described a sudden-onset pain that began while he was sitting comfortably in a chair smoking a cigar, nausea and vomiting, and nonbloody nonbilious stomach contents. He was hemodynamically stable. A stat outpatient CT was to be scheduled for the following day but was not performed until 6 days later, revealing a gangrenous gallbladder and requiring urgent operative intervention.

Comorbid conditions and multiple chronic conditions. Currently, it is estimated that four out of five older adults have MCCs, which generally refers to patients with two or more chronic physical or behavioral health conditions concurrently.⁴¹⁻⁴³ Age-related changes in physiology can include decreased organ function reserve and an increased prevalence of common comorbid conditions, including hypertension, cardiovascular disease, presbyopia, and hearing loss.⁴⁴

The National Council on Aging reports that 94.9 percent of adults age 60 or older have a chronic condition (with 78.7% having two or more) and describes the 10 common chronic conditions for adults over age 65, including:

- Hypertension (60%),
- High cholesterol (51%),
- Obesity (42%),
- Arthritis (35%),
- Ischemic/coronary heart disease (29%),
- Diabetes (27%),
- Chronic kidney disease (25%),
- Heart failure (15%),
- Depression (16%), and
- Alzheimer's disease and dementia (12%).⁴⁵

These and other comorbid conditions can affect the presentation of new diseases and obscure the clinical picture and ability to reach a timely, accurate diagnosis.

Individual patients may additionally differ in their interpretation of signs and symptoms as normal aging or part of their MCCs, potentially choosing not to report certain symptoms to their clinical provider, adding further complication to diagnostic decision making.⁴⁶⁻⁴⁸ Further, decreased sensation, cognitive decline, and functional limitations associated with the aging process can hinder an older adult's ability to interpret and accurately report symptoms. Clinicians need to adopt a comprehensive and multidimensional approach to diagnosis, incorporating patient-centered care principles⁴⁹ with their clinical judgment and evidence-based guidelines to navigate the complexities of aging and optimize diagnostic accuracy in older adults.

Communication barriers. Older adults may face communication barriers due to hearing loss, vision impairment, language barriers, or cognitive impairments, which can hinder the gathering of accurate medical history and symptom reporting. Older adults with cognitive impairments are particularly vulnerable throughout the diagnostic process, as they may have difficulty interpreting and articulating key symptoms essential for diagnosis during the clinical encounter and be written off as “poor historians” of their care.^{48,50}

Several studies have found that hearing loss is directly associated with longer delays in seeing the doctor⁵¹ and several unmet healthcare needs.⁵² Hearing is the basic substrate for oral communication throughout a clinical encounter. Thus, older adults are vulnerable to poor communication throughout all phases of the diagnostic continuum and in all care settings, especially in health environments with loud background noise and rapidly paced clinician speech.^{53,54}

In one study, researchers interviewed 59 older adults with hearing loss about the contexts of mishearing within a clinical setting. Patients reported occasions when problems of mishearing were focused on illness-related information and communication breakdowns where patients would miss what was being said by physicians and nurses entirely (e.g., communication of a diagnosis).⁵⁴ Despite the prevalence of hearing loss among older populations, few studies consider hearing loss in patient-provider communication⁵⁵ and to our knowledge, the relationship between hearing loss and diagnostic errors has not yet explicitly been explored.

Functional decline and health-related social needs. Recent research from the Centers for Disease Control and Prevention suggests that about 10 percent of adults over age 50 lack reliable transportation to meet their needs.⁵⁶ Lack of access to public transport can harm older people, especially those with frailty and functional impairments.⁵⁷ It is also a social determinant of health for this population, as it leads to reduced access to healthcare services, appointments, and social services.⁵⁸

MCCs, comorbidities, frailty, and cognitive impairment can affect older adults' ability to navigate healthcare facilities and keep necessary clinical appointments for diagnostic procedures or follow through with diagnostic testing. Older adults, even if functionally independent, may need a companion to help them with transportation, mobility, and visits to a healthcare facility. Clinical visits may therefore require the attendance of a "companion" (e.g., family member or unpaid caregiver) who may need to schedule time away from work to accompany the older adult to the appointment.

Socially isolated older adults (i.e., those who may not have an involved family member or friend) may find the use of healthcare services and diagnostic testing excessively burdensome. One study examined characteristics associated with dementia underdiagnosis in a nationally representative cohort of Medicare beneficiaries. Researchers found that older adult patients who attended doctor visits alone were more likely to be undiagnosed and unaware of a dementia diagnosis.⁵⁹ For certain stigmatized health concerns, such as mental illness, older adults may be less likely to follow through on referrals and care due to negative attitudes within society toward older adults and negative attitudes toward mental illness (i.e., "double stigmatization").^{60,61}

Polypharmacy and prescribing cascades. Adverse drug events from medication can often mimic acute medical conditions in older adults, thus contributing to diagnostic errors and a "prescribing cascade," where a second, potentially unnecessary drug is prescribed to treat the adverse drug event. For example, a class of antihypertensive medicines can cause leg swelling, which can often be misdiagnosed as heart failure in older adults, thus leading to the prescription of a diuretic medication.⁶²

In addition, incorrect medication reconciliation due to care fragmentation contributes to diagnostic errors. In the United States, electronic health records (EHRs) are not connected with community pharmacy records. Thus, patients have to accurately report all of their medications and doses to clinicians, or clinicians have to communicate and coordinate with patients' community pharmacies to compile an accurate medication list.

Older adults who take multiple medications and seek care from two or more healthcare systems are vulnerable to errors. In volume-based healthcare systems where primary care clinician appointments are time crunched and clinical pharmacists are generally not part of the primary care clinical team, inaccurate medication lists are common in these patients' EHRs, thereby contributing to diagnostic errors.^{63,64}

For example, a clinician newly involved in the care of an older adult with cognitive impairment who does not have access to records from other clinicians and community pharmacies may not know that the patient recently ran out of levothyroxine for hypothyroidism, which resulted in worsening visual hallucinations. This clinician may erroneously diagnose a mental illness and prescribe an antipsychotic medication.

Furthermore, older adults often see multiple providers using different EHRs that lack interoperability, making timely medication reconciliation challenging.

Clinician factors

Ageism/age bias. Ageism is “the stereotyping, prejudice, and discrimination against people on the basis of their age”⁶⁵ and can operate without conscious awareness and without intended malice.^{66,67} Ageism can be structural, interpersonal, or internalized and may impact a clinician’s ability to provide an accurate and timely diagnosis.⁶⁸

Typical ageist stereotypes may include beliefs about the frailty, senility, and dependence of older adult patients. These stereotypes can have several effects throughout the diagnostic continuum, including:

- Undertriage and underrecognition of geriatric syndromes;
- Assumptions of frailty, dependence, and impairment as a norm;
- Dismissive language and behavior around concerns; and/or
- Not addressing “what matters most” to older adults.⁶⁹

Several studies suggest that these biases are likely to influence diagnosis, particularly around mental health.⁷⁰ For example, the implicit notion that older people may naturally be expected to be depressed because of their age may lead to lower levels of screening for depression.²³

Cognitive factors. As clinicians face the challenge of diagnosing and managing complex clinical conditions during time-crunched appointment slots, thorough physical exams may get replaced by expensive diagnostic tests. Clinical judgment may be replaced by quick-to-use algorithm-based diagnostic tools. A thorough chart review can become burdensome or infeasible. In addition, older adults often present to their clinician with atypical presentation of an acute condition or exacerbation of chronic disease.

The cognitive factors that result in diagnostic errors in ambulatory care settings are particularly salient among older adults and include:

- Impaired judgment, vigilance, or memory;
- Lack of knowledge;
- Faulty data gathering and synthesis⁷¹; and
- Improper communication (e.g., inadequate handoffs, failure to establish clear lines of responsibility).⁷²

Without appropriate time and system support for a thorough assessment, the initial clinical response can be to attribute the condition to the patient’s age or to find a less likely but convenient label based on a false alert or superficial explanation of the patient’s symptoms. This response can result in a missed diagnosis. For example, acute delirium is often missed on inpatient services,⁷³ and acute or subacute functional decline is frequently labeled as failure to thrive, resulting in worse outcomes for aging patients.⁷⁴

Several studies show that older adults are frequently misdiagnosed with UTIs⁷⁵⁻⁷⁷ and pneumonia.^{78,79} Such misdiagnoses raise major concerns about the unnecessary prescription of antibiotics in this population and the impact of inappropriate antibiotic therapy, such as increased risk of drug interactions, negative health outcomes, and mortality.

Overdiagnosis and screening dilemmas. Overdiagnosis is also considered an undesirable diagnostic event⁸⁰ and is a common and significant problem within older adult populations. Overdiagnosis occurs when a test finds an abnormality that is technically a “true positive” but would have never caused actual illness, even if undiscovered and untreated.⁸¹ Overdiagnosis can be a result of overtesting, where a diagnostic test or screening is performed despite the lack of clear benefits or where benefits are outweighed by harm.⁸²

Screening without considering the patient’s holistic needs can reduce time available for more relevant and helpful discussions for older adult patients (e.g., reducing polypharmacy, healthy behavior counseling). It can also result in a diagnostic and treatment cascade for something that otherwise would not have caused symptoms during the patient’s lifetime.^{83,84} Cancer screening, for example, is commonly considered a standard practice in preventive medical care but it requires clinicians to consider patient preferences and weigh potential harms of screening and followup diagnostic tests (e.g., the “diagnostic cascade”) with the possibility of benefit.^{83,85-87}

Concerns of over-screening and its implications for overpayments have been raised. For example, among Medicare Advantage managed care enrollees, risk-score gaming aims to identify as many diagnostic codes as possible to improve profits. Some screening is for conditions in which asymptomatic screening is generally not recommended by the U.S. Preventive Services Task Force and expert societies.⁸⁸

Systemic and Organizational Factors

Diagnostic testing. Many of the common reference values for laboratory diagnostic tests are determined in young and healthy adults between the ages of 20 and 40. Validation of reference values for older adults can be challenging because the high underlying burden of illness among older adults makes it difficult to distinguish between age-related changes in physiology and pathologic changes.⁸⁹ For example, current pyuria cutoffs have been found to promote inappropriate UTI diagnosis in older women⁹⁰ and hematological reference intervals for frequently used laboratory tests in older adult populations are still under debate.^{89,91,92}

In the past 5 years, considerable efforts have taken place to evaluate and improve the diagnostic accuracy of screening tools specific to older adults and various geriatric conditions. For example, efforts to evaluate the diagnostic accuracy of tests for cognitive status or decline,^{93,94} geriatric depression,⁹⁵⁻⁹⁷ frailty,^{98,99} and undiagnosed hypothyroidism¹⁰⁰ are abundant in the scientific literature.

Clinical and methodological heterogeneity between studies can make it challenging to recommend one diagnostic test for use as a screening instrument over others. However, systematic reviews and meta-analyses can provide the highest possible grades of evidence and identify the most promising tools for improving diagnosis in specific settings and environments.⁸⁷

Fragmented care. Older adults are more likely to have MCCs and use multiple medications. They may experience “polydoctoring,” where patients see multiple healthcare providers and are at risk of fragmented care through a lack of coordination and effective communication between their multiple providers.¹⁰¹

Care fragmentation can result in excess testing and procedures^{102,103} and suboptimal quality and outcomes in the older adult population.^{104,105} Multiple healthcare providers may prescribe medications independently and without full awareness of the patient’s complete medical regimen, with the potential for drug-drug interactions that can mask or mimic symptoms of other conditions.

Older veteran populations who seek care at both the Department of Veterans Affairs (VA) and community health systems, for example, are especially likely to have overlapping medications from the same drug classes dispensed by the VA and community pharmacies.^{106,107} Evidence supports the relationship between highly fragmented care and a higher risk of hospitalization for these patients.¹⁰⁸

Other systemic factors include a primarily fee-for-service payment model that incentivizes volume over quality of patient encounters and reimbursement rules that favor procedural specialties over cognitive specialties. Thus, clinicians providing primary care services to older adults lack clinical support staff (e.g., registered nurses, clinical pharmacists, social workers, nutritionists) and face institutional pressure to maintain unrealistically large patient panel sizes. This scenario places older adults with MCCs at higher risk for diagnostic errors.

Insufficient workforce and geriatrics training. It is essential that all health professionals be familiar with common diagnostic challenges in caring for older patients, have basic competencies in the care of older adults, and contribute their perspectives through shared and collaborative care models. In addition, the growing U.S. population over 65 years old has created greater need for geriatrics physicians, nurses, and other healthcare workforce professionals to provide care for older adult patients across diverse care settings. However, the number of Board-certified geriatricians in the United States has fallen from 10,270 in 2000 to 8,502 in 2010 to 7,300 in 2021.¹⁰⁹ Fewer than 1 percent of U.S. physicians are certified in geriatrics.¹¹⁰

Major drivers of the persistently low recruitment into geriatrics care include:

- Compensation and a lack of financial incentives (e.g., despite having advanced fellowship training, geriatricians receive the same or lower compensation than general internists and family physicians),
- Low prestige of the specialty, and
- Limited exposure to strong geriatrics role models during training.¹¹⁰

Some progress has been made in enhancing the amount of geriatrics content in medical and nursing education curriculums, as well as expansion and growth of the geriatrics nurse practitioner workforce.¹¹¹ But a coordinated national effort to bolster the eldercare workforce is still urgently needed to improve our capacity to provide care for the rapidly growing population of older adults in the United States.

Among older adults, mental illnesses may go undiagnosed because physicians are not trained to recognize mental illness in this population and because of patients' reluctance to discuss their emotional difficulties.¹¹² Depression or anxiety among older adults may be a longstanding or newly developed problem brought on by the challenges of coping with physical and functional changes, living in isolation, and outliving family and friends.

A 2012 Institute of Medicine report estimated that approximately 5.6 million to 8 million Americans 65 years of age or older had mental health or substance use disorders, with the number predicted to reach 10.1 million to 14.4 million by 2030.¹¹³ This report noted that the United States did not have nearly enough professionals with the necessary training to screen, diagnose, and treat older adults with mental illness or substance abuse.

The United States needs to shift the delivery paradigm for mental health for older adults, including training diverse direct care and peer-support providers who can support diagnosis and perform interventions.¹¹⁴ Care models using an interdisciplinary care team approach have been shown to improve quality and outcomes of older adults.

The Geriatric Resources for Assessment and Care of Elders (GRACE)^{115,116} model incorporates an interdisciplinary team, including a nurse practitioner and social worker, to collaborate with primary care providers and perform assessment and care management in patients' homes. This model has resulted in decreased hospital admissions within the high-risk group.^{115,116} The model has been successfully replicated in numerous settings, including both fee-for-service and capitation payment models.

The Program of All Inclusive Care for the Elderly (PACE)¹¹⁷ is an interdisciplinary care model for older adults in the community who need nursing home-level care. It provides high-quality and cost-effective acute and chronic disease management to enrollees in their homes.

Implications for Practice Improvement, Research, and Policy

Based on the available literature and identified gaps, we describe current practice improvement strategies, high-priority research topics and questions, and implications for policy to advance diagnostic safety in the older adult population.

Practice Improvement

Quality care for older adult patients relies on a comprehensive and coordinated approach to healthcare, including but not limited to preventive care, chronic disease management, and end-of-life care, to address their unique, diverse, and evolving needs. Recent efforts have called for the study and mitigation of harm from diagnostic errors in older adult populations. For example, a 2022 National Academies of Sciences, Engineering, and Medicine (NASEM) workshop, *Advancing Diagnostic Excellence for Older Adults*,⁶ suggested strategies to improve diagnostic quality, including:

- Listen to older adults and their personal stories to enhance their voice in their care plan.
- Implement environmental modifications and intentional training in communication for clinicians to reduce barriers to the healthcare system for older adults with hearing loss.
- Shift shared decision making from being disease focused to being better aligned with patient priorities.
- Meaningfully involve family members and caregivers in the communication and diagnostic process.
- Integrate medication data in EHRs to help clinicians provide structured monitoring and followup of new medications, improve medication use, and reduce harm and burden.
- Identify and understand cultural factors to improve diagnosis and care.
- Provide more culturally relevant education on dementia symptoms and diagnosis to diverse communities.

Ongoing efforts to reduce diagnostic errors specifically in older adult populations are highlighted below.

The 4Ms and Age-Friendly Health Systems Initiatives. In their work to create Age-Friendly Health Systems to rethink care for older adults, The John A. Hartford Foundation developed the 4Ms framework to help system leaders and frontline teams consistently deliver high-quality, age-friendly care.¹¹⁸ This framework has been widely implemented across inpatient, ambulatory practices, convenience clinics, and nursing homes.

From a diagnostic perspective, the 4Ms framework can include:

1. **What Matters:** understanding patients' health goals and care preferences to know and align diagnostic priorities and workup decisions, involving care partners per patient preference, and basing diagnostic decisions not solely on chronological age or age-based assumptions;
2. **Medication:** recognizing that medication side effects and drug-drug interactions may contribute to common symptoms and should be considered in the differential diagnoses and assessing the potential for polypharmacy and prescribing cascades;
3. **Mentation:** identifying changes in cognition, including early recognition of dementia, depression, and delirium across care settings; and
4. **Mobility:** evaluating changes in mobility thoroughly and ensuring that older adults can move safely to maintain function and achieve what matters to them.

Geriatric emergency departments. The establishment and rapid growth of accredited geriatric EDs (designation of a separate space for older adults or integration of best practices for older adults into EDs) support diagnostic improvement efforts for older adults. The concept of a geriatric ED was established in response to the growing geriatric population, higher rates of emergency department visits than nonseniors, and need for more extensive and complex evaluations.^{119,120}

By ensuring the resources to provide quality care and best practices to older adults at their encounter, geriatric EDs are a promising solution to improving diagnostic quality efforts for this high-risk population. A 2023 study compared diagnosis rates and outcomes in geriatric and nongeriatric EDs. Researchers found higher geriatric syndrome diagnosis rates (e.g., UTIs, dementia, and delirium/altered mental status states) and lower ED lengths of stay by older adults in geriatric EDs compared with matched nongeriatric EDs.¹²¹

Geriatrics educational interventions. Efforts to increase geriatrics competencies among health professionals who care for older adults have included a diagnostic competency component and can reduce harm from missed diagnostic opportunities. For example, the Advancing Geriatrics Academic Programs from the Association of Directors of Geriatrics Academic Programs (ADGAP) describes minimum competencies for medical students. The competencies are based on the American Geriatrics Society Geriatric 5Ms, which include:

1. **Mind** (i.e., mentation, dementia, delirium, and depression);
2. **Mobility** (i.e., assessment for mobility and function and fall risk screening and management);
3. **Medications** (i.e., polypharmacy and deprescribing, medication reconciliation, and adverse medication effects);
4. **Multicomplexity** (i.e., describing the whole person, living with MCCs, advanced illness, and/or complicated biopsychosocial needs); and
5. **What matters most** (i.e., identifying an individual's own meaningful health outcome goals and care preferences).¹²²

Competencies specifically related to diagnosis in the ADGAP Advancing Geriatrics Academic Programs relate to:

- Expedited diagnosis of delirium;
- Consideration of conditions that may present uniquely in older adults when constructing a differential diagnosis for an older patient with an acute concern (e.g., infections, surgical emergencies, cardiac conditions, and electrolyte abnormalities);
- Identifying changes of normal aging within each organ system and how these impact function, physiologic reserve, diagnosis, and treatment; and
- Demonstrating inclusion of prognostic information, frailty status, and patient preference in recommendations for screening, diagnosis, treatment, and end-of-life care.¹²²

Patient-provider communication interventions. A 2023 rapid review examined the effects of patient-provider communication strategies among older adult patients. The review identified seven studies (primarily using qualitative and observational approaches) that reported better performance on several patient-centered outcomes, such as patient satisfaction, quality of care, and quality of life associated with better communication strategies.¹²³

Evidence-based interventions aimed at enhancing communication between older adult patients, family members and caregivers, and their care providers include those focused on shared decision making¹²⁴ or advance care planning (e.g., SHARING Choices).¹²⁵ Such interventions typically rely on the communication of a diagnosis as a precursor to discussing treatment decisions. Thus, the implementation of these interventions may also improve the communication of an existing or potential diagnosis as part of proactively addressing the needs of older adults in their care appointments.

Similarly, interventions aimed at engaging patients or improving the information-gathering and history-taking aspects of clinical care for general patient populations can likely improve diagnostic communication for older adult populations at earlier stages in the diagnostic process. Examples include AHRQ’s “Be the Expert on You” planning worksheet¹²⁶ and the Institute for Healthcare Improvement’s My Health Checklist.¹²⁷

Decision support tools. The use of diagnostic clinical decision support tools and technologies, such as those that support the detection of infection, are promising avenues for improving the diagnostic process for both high-risk and general populations. A scoping review of the literature from 2010-2021 found 17 papers where decision support tools improved the detection of several different types of infection in older people (e.g., urine, respiratory, sepsis), with tools most frequently being deployed within hospital settings.¹²⁸ For older adult populations, the use of these tools and technologies requires specific consideration around their implementation in practice to create an optimally validated and tested intervention.

Research

A growing number of research and clinical experts, advocates and stakeholders, and healthcare leaders recognize that diagnostic safety research is a priority for geriatric care. Despite the body of evidence around the occurrence of diagnostic errors, research evaluating the implementation and outcomes of diagnostic safety interventions, particularly those tailored to older adult populations, is lacking.

In the final session at the NASEM Advancing Diagnostic Excellence for Older Adults workshop, experts and panelists reflected on their visions for diagnostic excellence in older adults. They emphasized the need to prioritize what matters to the patient most and develop “a system that cares for people who are living

with illness or multiple conditions in the context of their lives aligned with their goals and preferences, as opposed to our current disease focused system.”⁶

The three research priorities that were identified and included in the workshop summary included:

- Expand inclusion of older adults in clinical trials and research studies;
- Collect high-quality data on older adults to better develop clinical artificial intelligence systems that consider the complex challenges specific to older adults; and
- Partner with community organizations to help assess the needs of older adult populations and identify successful programs and communities, seeking to understand which characteristics of their settings encourage success.⁶

In addition, a 2024 AHRQ Special Emphasis Notice encourages health services researchers to address several key priorities related to diagnostic excellence in older adults.¹²⁹ Researchers should consider research questions around the coordination of care for older adults and patients with MCCs across providers and care settings. They focus on inequities in health and healthcare, as well as the evaluation of person-centered, whole-person healthcare delivery that appropriately addresses the needs, health goals, and priorities of older adults throughout the diagnostic process. Delivery interventions aimed at improving care delivery, particularly those that foster well-being and reduce the burden on clinicians and interdisciplinary teams, also need to be implemented and spread.

Finally, researchers should consider the roles of caregivers in patient-facing interventions and increase efforts to include caregivers in diagnostic safety research on older adults. Today, more than one in five Americans are caregivers¹³⁰ and it is estimated that at least 17.7 million individuals in the United States are family caregivers of someone over age 50 who needs help because of a limitation in physical, mental, or cognitive functioning.¹³¹

Because they help maintain the health and care needs of older adults, caregivers are critical historians and messengers when it comes to reporting patterns of older adults’ day-to-day lives and recognizing any acute changes in cognitive and behavioral symptoms.¹³² Unfortunately, caregivers have very few formal channels to share information that could be essential to improving diagnosis. Tools to enhance caregiver communication with providers have been developed. But these efforts mostly focus on:

- Acknowledging and addressing caregivers’ needs and perspectives generally,¹³³⁻¹³⁶
- Understanding and enhancing caregiver engagement through online patient portals,¹³⁷⁻¹⁴⁰ or
- Including caregivers in shared decision making after a diagnosis has been made.^{141,142}

Although providers may informally rely on caregiver input and information during the diagnostic process, few tools formally incorporate caregiver perspectives into the process of establishing or communicating diagnoses. Future research efforts to meaningfully include patients, caregivers, and clinical perspectives and co-design interventions to improve diagnostic safety are urgently needed. Research to evaluate the implementation and scale-up of care delivery interventions aimed at improving care delivery and communication for older adult populations is also needed.

Policy

Diagnostic errors are a multipronged problem, as discussed earlier. They have roots in a payment system that favors volume over value. Additional issues include knowledge gaps among clinicians, cognitive fatigue of clinicians evaluating complex medical conditions in time-limited appointments, lack of clinical support experienced by clinicians, and distraction due to competing clinical challenges during an encounter.

Policy recommendations from NASEM's 2015 *Improving Diagnosis in Health Care* report⁷ included:

- Goal 6: developing a reporting environment and medical liability system that facilitates timely identification, disclosure, and learning from diagnostic errors;
- Goal 7: designing a payment and care delivery system that supports the diagnostic process; and
- Goal 8: providing dedicated funding for research on the diagnostic process and diagnostic errors through a coordinated research agenda.

These policy recommendations were not specific to older adults, so we have additional considerations and opportunities to highlight for this population.

Policies and initiatives aimed at broadly improving care for older adults will also help improve diagnostic safety in this population. For example, efforts to improve holistic, person-centered coordinated care and support for incorporating geriatrics competencies in healthcare workforce training programs have direct implications for reducing diagnostic errors and improving diagnostic accuracy for older adults. Initiatives aimed at improving diagnostic accuracy cannot bring any meaningful change without a strong commitment toward improving the general medical care of older adults and a holistic approach to all factors that affect the provision of safe medical care to older adults.

Current challenges to improving care for older adults include, but are not limited to, a fragmented healthcare system, clinician burnout, a payment system that values quantity over quality and procedural care over preventive care, and a dwindling geriatrics workforce. In short, reducing diagnostic errors for older adults requires transformative changes in the U.S. healthcare system.

Below are several recommendations, adapted from the NASEM report and other referenced resources that can inform policy discussions to improve care of older adults broadly and support diagnostic accuracy in this growing population.

Developing policies to support the voluntary reporting of diagnostic errors and near-misses. The first step in reporting a diagnostic error is detecting the error. However, reporting diagnostic errors in older adults is complicated because geriatric syndromes and other misdiagnosed conditions rely on the clinical decision making of expert clinicians and cannot be diagnosed solely by diagnostic tests or pathology examinations.

For example, delirium can be misdiagnosed as dementia, asymptomatic bacteriuria can be misdiagnosed as a UTI, and acute functional decline can be labeled “old age.” In these cases, determining whether a diagnostic error has occurred relies on an expert clinician to thoroughly review the medical chart and obtain additional, potentially overlooked but clinically relevant history from the patient or an informed caregiver. Therefore, while research supports the frequent misdiagnoses of geriatric syndromes, the reported diagnostic errors pertaining to geriatric syndromes are likely just the tip of the iceberg.

Policies are needed to support all clinicians caring for older adults in voluntarily and forthrightly reviewing cases and reporting diagnostic errors. In addition, healthcare systems need to develop a nonpunitive culture that encourages active surveillance, reporting, and learning from diagnostic errors. The Patient Safety and Quality Improvement Act (PSQIA)¹⁴³ and AHRQ's Patient Safety Organization (PSO) program¹⁴⁴ have established voluntary reporting requirements for healthcare providers for medical errors. These requirements can be broadened to cover diagnostic errors, including formats to report commonly misdiagnosed geriatric syndromes.

A few states have enacted "I am sorry" legislation that prevents healthcare providers' disclosure of medical errors to patients from being used against them in a court of law.¹⁴⁵ Such laws can provide safe harbor to healthcare providers and healthcare systems for voluntarily reporting diagnostic errors and becoming allies with patients in improving diagnostic processes. Still, policies are needed to further incentivize and encourage clinicians to report these errors to improve care processes and learning.

Establishing payer-related policies to improve healthcare quality and value. Primary care visits are often time limited and do not allow sufficient time for clinicians to fully address the complexity of care for older patients.¹⁴⁶ Payers need to recognize the urgent need to support payments for care provided by primary care clinical teams instead of care provided by a single provider. This approach was recommended by the NASEM report *Implementing High-Quality Primary Care: Rebuilding the Foundation of Healthcare*.¹⁴⁷

Procedural codes that allow other healthcare providers, such as pathologists, radiologists, and geriatricians, to provide advice to healthcare providers regarding the interpretation of diagnostic studies and management of geriatric syndromes are also needed. National efforts to implement quality measures that include screening for delirium and frailty offer tremendous potential to improve diagnostic safety in older adults. For example, the Centers for Medicare & Medicaid Services intends to incorporate age-friendly hospital quality measures in the Hospital Inpatient Quality Reporting Program beginning in 2025. These measures will encourage healthcare systems to develop screening and management protocols for geriatric syndromes that are often undiagnosed on inpatient services.¹⁴⁸

Improving graduate medical education and interdisciplinary geriatric training. Geriatrics training and competency development for healthcare professionals and researchers are central to achieving diagnostic excellence in older adults. This training should be a mandatory component of all adult clinical specialty residency and fellowship programs for physician and nonphysician healthcare professionals.

The Veterans Health Administration has championed the mission of interdisciplinary geriatrics education by supporting a geriatric medicine residency for nurse practitioners.¹⁴⁹ The Health Resources and Services Administration provides funding to institutions that collaborate with community programs through the Geriatrics Workforce Enhancement Program.¹⁵⁰ Similar programs could be developed for other professional domains in healthcare to support an age-friendly workforce.

Geriatrics training should also include didactic and practical education on diagnostic safety and support interdisciplinary collaboration and team-based approaches to safety. Additional investments are also needed to develop and establish future leaders in geriatrics diagnostic safety research and improvement.

Developing meaningful patient-level measures and outcome assessment for older adults. Clinical guidelines have pointed to the importance of providing and tracking goal-based, patient-centered care, where “care is personalized and aligned with patients’ goals.”¹⁵¹ The establishment of well-defined patient-level measures and outcomes, particularly for older adults with MCCs and comorbidities, can provide a consistent method to evaluate whether a diagnostic workup can help patients achieve the outcomes that are important to them. This approach can help reduce the risk of overtesting and resulting harms.

Efforts to improve the integration of patient-level measures into organizations and care practices, as well as into existing financial reimbursement systems, offer great potential for better aligning care with what matters and reducing unnecessary tests and diagnostic harm in older adults.

Increasing support for research on diagnostic safety in older adults. The achievement of diagnostic excellence for older adults will involve coordinating resources from a broad array of disciplines, stakeholders, and institutions to translate evidence-based interventions that will improve diagnosis and reduce harm. Public and private funding organizations can be supported in funding projects related to diagnostic safety in older adults. Active efforts must be made to advocate for and support partnerships between researchers, healthcare leaders, frontline clinicians, and patient stakeholder groups that can carry out work to improve diagnosis of older adults.

Quality and safety collaboratives working on care of older adults must include diagnostic excellence as a key patient safety goal and prioritize projects that improve diagnosis. In addition, research and professional networks, societies, and organizations focused on older adults need to provide resources and support for initiatives to promote diagnostic excellence in settings across the geriatric care continuum.

Conclusion

Older adult populations face many unique challenges to diagnostic safety. Despite increased attention to the burden and causes of diagnostic errors among older adults, implementation and testing of interventions to reduce diagnostic errors has been lagging. Research efforts are needed to meaningfully partner with older adults to co-design interventions, include older adults in more clinical trials and research studies, better define patient-level measures and outcomes, and improve data collection related to diagnostic safety of older adults.

In the policy arena, next steps to achieving diagnostic excellence for older adults include establishing team-based payment models and policies, enhancing training in geriatrics for healthcare professionals and researchers, funding research that focuses on diagnostic errors in older adults, and better defining patient-level measures and outcomes.

References

Note: All web pages were accessed July 23, 2024.

1. Caplan Z, Rabe M. The Older Population: 2020. Suitland, MD: U.S. Census Bureau; May 25, 2023. Report Number: C2020BR-07. <https://www.census.gov/library/publications/2023/decennial/c2020br-07.html>.
2. Mather M, Jacobsen LA, Pollard KM. Aging in the United States. Population Bulletin 2015 Dec;70(2). <https://www.prb.org/wp-content/uploads/2019/07/population-bulletin-2015-70-2-aging-us.pdf>.
3. Urban Institute. The U.S. Population Is Aging. <https://www.urban.org/policy-centers/cross-center-initiatives/program-retirement-policy/projects/data-warehouse/what-future-holds/us-population-aging>.
4. Singh H, Meyer AN, Thomas EJ. The frequency of diagnostic errors in outpatient care: estimations from three large observational studies involving U.S. adult populations. *BMJ Qual Saf*. 2014;23(9):727-731. <https://doi.org/10.1136/bmjqs-2013-002627>.
5. Skinner TR, Scott IA, Martin JH. Diagnostic errors in older patients: a systematic review of incidence and potential causes in seven prevalent diseases. *Int J Gen Med*. 2016 May 20;9:137-146. <https://pubmed.ncbi.nlm.nih.gov/27284262/>.
6. National Academies of Sciences, Engineering, and Medicine. Advancing Diagnostic Excellence for Older Adults: Proceedings of a Workshop-in Brief. Washington, DC: National Academies Press;2022:1-12. <https://doi.org/10.17226/26789>.
7. National Academies of Sciences, Engineering, and Medicine, Committee on Diagnostic Error in Health Care; Board on Health Care Services; Institute of Medicine. Balogh E, Miller B, Ball J, eds. Improving Diagnosis in Health Care. Washington, DC: National Academies Press; 2015. <https://pubmed.ncbi.nlm.nih.gov/26803862/>.
8. Zwaan L, El-Kareh R, Meyer AND, Hooftman J, Singh H. Advancing diagnostic safety research: results of a systematic research priority setting exercise. *J Gen Intern Med*. 2021 Oct;36(10):2943-2951. <https://pubmed.ncbi.nlm.nih.gov/33564945/>.
9. Zwaan L, Smith KM, Giardina TD, Hooftman J, Singh H. Patient generated research priorities to improve diagnostic safety: a systematic prioritization exercise. *Patient Educ Couns*. 2023 May;110:107650. <https://pubmed.ncbi.nlm.nih.gov/36731167/>.
10. Orimo H, Ito H, Suzuki T, Araki A, Hosoi T, Sawabe M. Reviewing the definition of “elderly.” *Geriatr Gerontol Intl*. 2006 Aug 16;6(3):149-158. <https://doi.org/10.1111/j.1447-0594.2006.00341.x>.
11. National Institutes of Health. NIH Style Guide: Age. Page last reviewed January 17, 2024. <https://www.nih.gov/nih-style-guide/age#:~:text=The%20National%20Institute%20on%20Aging,definitions%20of%20older%20adulthood%20vary>.
12. Guss D, Sherigar J, Mohanty SR. Missed diagnosis of liver cirrhosis leads to disparities in care for older patients. *Gastroenterology Res*. 2018 Oct;11(5):333-339. <https://pubmed.ncbi.nlm.nih.gov/30344803/>.
13. Lien CT, Gillespie ND, Struthers AD, McMurdo ME. Heart failure in frail elderly patients: diagnostic difficulties, co-morbidities, polypharmacy, and treatment dilemmas. *Eur J Heart Fail*. 2002 Jan;4(1):91-98. <https://pubmed.ncbi.nlm.nih.gov/11812669/>.

14. Kwak SH, Choi JS, Lee EH, Lee SH, Leem AY, Lee SH, Kim SY, Chung KS, Jung JY, Park MS, Kim YS, Chang J, Kang YA. Characteristics and risk factors associated with missed diagnosis in patients with smear-negative pulmonary tuberculosis. *Korean J Intern Med.* 2021 Mar;36(Suppl 1):S151-S159. <https://pubmed.ncbi.nlm.nih.gov/32811133/>.
15. Lee CH, Wang JY, Lin HC, Lin PY, Chang JH, Suk CW, Lee LN, Lan CC, Bai KJ. Treatment delay and fatal outcomes of pulmonary tuberculosis in advanced age: a retrospective nationwide cohort study. *BMC Infect Dis.* 2017 Jun 24;17(1):449. <https://pubmed.ncbi.nlm.nih.gov/28646854/>.
16. Miller AC, Arakkal AT, Koeneman S, Cavanaugh JE, Gerke AK, Hornick DB, Polgreen PM. Incidence, duration, and risk factors associated with delayed and missed diagnostic opportunities related to tuberculosis: a population-based longitudinal study. *BMJ Open.* 2021 Feb 18;11(2):e045605. <https://pubmed.ncbi.nlm.nih.gov/33602715/>.
17. Battaglia S, Benfante A, Spatafora M, Scichilone N. Asthma in the elderly: a different disease? *Breathe (Sheff).* 2016 Mar;12(1):18-28. <https://pubmed.ncbi.nlm.nih.gov/27064568/>.
18. Bellia V, Pedone C, Catalano F, Zito A, Davi E, Palange S, Forastiere F, Incalzi RA. Asthma in the elderly: mortality rate and associated risk factors for mortality. *Chest.* 2007 Oct;132(4):1175-1182. <https://pubmed.ncbi.nlm.nih.gov/17890479/>.
19. Zhou Y, Singh H, Hamilton W, Archer S, Tan S, Brimicombe J, Lyratzopoulos G, Walter FM. Improving the diagnostic process for patients with possible bladder and kidney cancer. *Br J Gen Pract.* 2023 Jul 27;73(733):e575-e585. <https://pubmed.ncbi.nlm.nih.gov/37253628/>.
20. Summerfield C, Smith L, Todd O, Renzi C, Lyratzopoulos G, Neal RD, Jones D. The effect of older age and frailty on the time to diagnosis of cancer: a connected Bradford electronic health records study. *Cancers (Basel).* 2022 Nov 18;14(22):5666. <https://pubmed.ncbi.nlm.nih.gov/36428757/>.
21. Massa E, Donisi C, Liscia N, Madeddu C, Impera V, Mariani S, Scartozzi M, Lai E. The difficult task of diagnosing depression in elderly people with cancer: a systematic review. *Clin Pract Epidemiol Ment Health.* 2021 Dec 31;17(1):295-306. <https://pubmed.ncbi.nlm.nih.gov/35444712/>.
22. Mitchell AJ, Rao S, Vaze A. Do primary care physicians have particular difficulty identifying late-life depression? A meta-analysis stratified by age. *Psychother Psychosom.* 2010;79(5):285-294. <https://pubmed.ncbi.nlm.nih.gov/20616623/>.
23. Burroughs H, Lovell K, Morley M, Baldwin R, Burns A, Chew-Graham C. 'Justifiable depression': how primary care professionals and patients view late-life depression? A qualitative study. *Fam Pract.* 2006 Jun;23(3):369-377. <https://pubmed.ncbi.nlm.nih.gov/16476699/>.
24. Boureau AS, Guyomarch B, Gourdy P, Allix I, Annweiler C, Cervantes N, Chapelet G, Delabrière I, Guyonnet S, Litke R, Paccalin M, Penfornis A, Saulnier PJ, Wargny M, Hadjadj S, de Decker L, Cariou B. Nocturnal hypoglycemia is underdiagnosed in older people with insulin-treated type 2 diabetes: the HYPOAGE observational study. *J Am Geriatr Soc.* 2023 Jul;71(7):2107-2119. <https://pubmed.ncbi.nlm.nih.gov/36965179/>.
25. Mitnitski AB, Graham JE, Mogilner AJ, Rockwood K. Frailty, fitness, and late-life mortality in relation to chronological and biological age. *BMC Geriatr.* 2002 Feb 27;2:1. <https://pubmed.ncbi.nlm.nih.gov/11897015/>.
26. Hanson MA, Cooper C, Aihie Sayer A, Eendebak RJ, Clough GF, Beard JR. Developmental aspects of a life course approach to healthy ageing. *J Physiol.* 2016 Apr 15;594(8):2147-2160. <https://pubmed.ncbi.nlm.nih.gov/26518329/>.

27. Rockwood K, Howlett SE. Age-related deficit accumulation and the diseases of ageing. *Mech Ageing Dev.* 2019 Jun;180:107-116. <https://pubmed.ncbi.nlm.nih.gov/31002924/>.
28. Levine ME. Modeling the rate of senescence: can estimated biological age predict mortality more accurately than chronological age? *J Gerontol A Biol Sci Med Sci.* 2013 Jun;68(6):667-674. <https://pubmed.ncbi.nlm.nih.gov/23213031/>.
29. Clifford KM, Dy-Boarman EA, Haase KK, Maxvill K, Pass SE, Alvarez CA. Challenges with diagnosing and managing sepsis in older adults. *Expert Rev Anti Infect Ther.* 2016;14(2):231-241. <https://pubmed.ncbi.nlm.nih.gov/26687340/>.
30. Girard TD, Ely EW. Bacteremia and sepsis in older adults. *Clin Geriatr Med.* 2007 Aug;23(3):633-647, viii. <https://pubmed.ncbi.nlm.nih.gov/17631238/>.
31. Bellmann-Weiler R, Weiss G. Pitfalls in the diagnosis and therapy of infections in elderly patients--a mini-review. *Gerontology.* 2009;55(3):241-249. <https://pubmed.ncbi.nlm.nih.gov/19147988/>.
32. Tavares J, Figueiredo D, Passos L, Sobrinho L, Souza E, Pedreira L. Atypical presentation of COVID-19 in older adults: a scoping review. *Port J Public Health.* 2023 Oct 27;41(3):98-217. <https://doi.org/10.1159/000534250>.
33. Leichsenring F, Fonagy P, Heim N, Kernberg OF, Leweke F, Luyten P, Salzer S, Spitzer C, Steinert C. Borderline personality disorder: a comprehensive review of diagnosis and clinical presentation, etiology, treatment, and current controversies. *World Psychiatry.* 2024 Feb;23(1):4-25. <https://pubmed.ncbi.nlm.nih.gov/38214629/>.
34. Beatson J, Broadbear JH, Sivakumaran H, George K, Kotler E, Moss F, Rao S. Missed diagnosis: the emerging crisis of borderline personality disorder in older people. *Aust N Z J Psychiatry.* 2016 Dec;50(12):1139-1145. <https://pubmed.ncbi.nlm.nih.gov/27056175/>.
35. Limpawattana P, Phungoen P, Mitsungnern T, Laosuangkoon W, Tansangworn N. Atypical presentations of older adults at the emergency department and associated factors. *Arch Gerontol Geriatr.* 2016 Jan-Feb;62:97-102. <https://pubmed.ncbi.nlm.nih.gov/26323650/>.
36. Barrett CA, Hoover DL. Differential screen and treatment of vestibular dysfunction in an elderly patient: a case report. *Physiother Theory Pract.* 2023;39(2):441-452. <https://pubmed.ncbi.nlm.nih.gov/34978248/>.
37. Cosme I, Nobre E, Bugalho MJ. Newly diagnosed type 1 diabetes in an elderly patient. *Cureus.* 2023;15(8):e43646. <https://pubmed.ncbi.nlm.nih.gov/37719609/>.
38. Guibentif L, Ris F, Scheffler M, Reny JL, Prendki V. Acute appendicitis in elderly adults: a difficult diagnosis. *J Am Geriatr Soc.* 2016;64(6):1377-1379. <https://pubmed.ncbi.nlm.nih.gov/27321632/>.
39. Lamjoun M, Jelti A, Elghazouani F, Barrimi M. Normal pressure hydrocephalus and mania symptoms: case report. *Radiol Case Rep.* 2023;18(7):2397-2400. <https://pubmed.ncbi.nlm.nih.gov/37275741/>.
40. Hoyt KS, Jordan KS. The diagnostic challenge of an older adult with epigastric pain in the emergency department: high risk and high volume. *Adv Emerg Nurs J.* 2023;45(3):187-194. <https://pubmed.ncbi.nlm.nih.gov/37501269/>.
41. Diederichs C, Berger K, Bartels DB. The measurement of multiple chronic diseases: a systematic review on existing multimorbidity indices. *J Gerontol A Biol Sci Med Sci.* 2011 Mar;66(3):301-311. <https://pubmed.ncbi.nlm.nih.gov/21112963/>.
42. Drye EE, Altaf FK, Lipska KJ, Spatz ES, Montague JA, Bao H, Parzynski CS, Ross JS, Bernheim SM, Krumholz HM, Lin Z. Defining multiple chronic conditions for quality measurement. *Med Care.* 2018 Feb;56(2):193-201. <https://pubmed.ncbi.nlm.nih.gov/29271820/>.

43. Multiple Chronic Conditions Resource Center. Clinical Practice Resources & Guidelines. 2024. [https://multiplechronicconditions.org/#:~:text=Multiple%20Chronic%20Conditions%20\(MCC\)%20means,number%20of%20children%20have%20MCCs](https://multiplechronicconditions.org/#:~:text=Multiple%20Chronic%20Conditions%20(MCC)%20means,number%20of%20children%20have%20MCCs).
44. van den Akker M, Buntinx F, Metsemakers JF, Roos S, Knottnerus JA. Multimorbidity in general practice: prevalence, incidence, and determinants of co-occurring chronic and recurrent diseases. *J Clin Epidemiol*. 1998 May;51(5):367-375. <https://pubmed.ncbi.nlm.nih.gov/9619963/>.
45. National Council on Aging. The Top 10 Most Common Chronic Conditions in Older Adults. May 30, 2024. <https://www.ncoa.org/article/the-top-10-most-common-chronic-conditions-in-older-adults>.
46. McGilton KS, Vellani S, Yeung L, Chishtie J, Commisso E, Ploeg J, Andrew MK, Ayala AP, Gray M, Morgan D, Chow AF, Parrott E, Stephens D, Hale L, Keatings M, Walker J, Wodchis WP, Dubé V, McElhaney J, Puts M. Identifying and understanding the health and social care needs of older adults with multiple chronic conditions and their caregivers: a scoping review. *BMC Geriatr*. 2018 Oct 1;18(1):231. <https://pubmed.ncbi.nlm.nih.gov/30285641/>.
47. Foo KM, Sundram M, Legido-Quigley H. Facilitators and barriers of managing patients with multiple chronic conditions in the community: a qualitative study. *BMC Public Health*. 2020 Feb 27;20(1):273. <https://pubmed.ncbi.nlm.nih.gov/32106838/>.
48. Morgan R, Pendleton N, Clague JE, Horan MA. Older people's perceptions about symptoms. *Br J Gen Pract*. 1997 Jul;47(420):427-430. <https://pubmed.ncbi.nlm.nih.gov/9281869/>.
49. American Geriatrics Society Expert Panel on Person-Centered Care. Person-centered care: a definition and essential elements. *J Am Geriatr Soc*. 2016 Jan;64(1):15-18. <https://pubmed.ncbi.nlm.nih.gov/26626262/>.
50. Fisher JM. 'The poor historian': heart sink? Or time for a re-think? *Age Ageing*. 2016 Jan;45(1):11-13. <https://pubmed.ncbi.nlm.nih.gov/26683047/>.
51. Lin HH, Willink A, Jilla AM, Weinreich HM, Oh ES, Robertson M, Ward HV, Reed NS. Healthcare-seeking behaviors among Medicare beneficiaries by functional hearing status. *J Aging Health*. 2021 Oct;33(9):764-771. <https://pubmed.ncbi.nlm.nih.gov/33913771/>.
52. Reed NS, Assi L, Horiuchi W, Hoover-Fong JE, Lin FR, Ferrante LE, Inouye SK, Miller Iii ER, Boss EF, Oh ES, Willink A. Medicare beneficiaries with self-reported functional hearing difficulty have unmet health care needs. *Health Aff (Millwood)*. 2021 May;40(5):786-794. <https://pubmed.ncbi.nlm.nih.gov/33939509/>.
53. Shukla A, Nieman CL, Price C, Harper M, Lin FR, Reed NS. Impact of hearing loss on patient-provider communication among hospitalized patients: a systematic review. *Am J Med Qual*. 2019 May/Jun;34(3):284-292. <https://pubmed.ncbi.nlm.nih.gov/30196712/>.
54. Cudmore V, Henn P, O'Tuathaigh CMP, Smith S. Age-related hearing loss and communication breakdown in the clinical setting. *JAMA Otolaryngol Head Neck Surg*. 2017 Oct 1;143(10):1054-1055. <https://pubmed.ncbi.nlm.nih.gov/28837709/>.
55. Cohen JM, Blustein J, Weinstein BE, Dischinger H, Sherman S, Grudzen C, Chodosh J. Studies of physician-patient communication with older patients: how often is hearing loss considered? A systematic literature review. *J Am Geriatr Soc*. 2017 Aug;65(8):1642-1649. <https://pubmed.ncbi.nlm.nih.gov/28436026/>.
56. Ng AE, Adjaye-Gbewonyo D, Dahlhamer J. Lack of reliable transportation for daily living among adults: United States, 2022. NCHS Data Brief, no. 490. Hyattsville, MD: National Center for Health Statistics; January 2024. <https://www.cdc.gov/nchs/products/databriefs/db490.htm>.

57. Shrestha BP, Millonig A, Hounsell NB, McDonald M. Review of public transport needs of older people in European context. *J Popul Ageing*. 2017;10(4):343-361. <https://pubmed.ncbi.nlm.nih.gov/29104702/>.
58. Heaps W, Abrahsohn E, Skillen E. Public transportation in the U.S.: a driver of health and equity. *Health Aff*. 2021 Jul 29. <https://www.healthaffairs.org/content/briefs/public-transportation-us-driver-health-and-equity>.
59. Amjad H, Roth DL, Sheehan OC, Lyketsos CG, Wolff JL, Samus QM. Underdiagnosis of dementia: an observational study of patterns in diagnosis and awareness in U.S. older adults. *J Gen Intern Med*. 2018 Jul;33(7):1131-1138. <https://pubmed.ncbi.nlm.nih.gov/29508259/>.
60. Bodner E, Palgi Y, Wyman MF. Ageism in mental health assessment and treatment of older adults. In: Ayalon L, Tesch-Römer C, eds. *Contemporary Perspectives on Ageism. International Perspectives on Aging*, vol.19. Cham, Switzerland: Springer Cham; 2018. pp. 241-262. <https://doi.org/10.1007/978-3-319-73820-8>.
61. Werner P, Stein-Shvachman I, Heinik J. Perceptions of self-stigma and its correlates among older adults with depression: a preliminary study. *Int er*. 2009 Dec;21(6):1180-1189. <https://pubmed.ncbi.nlm.nih.gov/19586565/>.
62. Rochon PA, Austin PC, Normand S-L, Savage RD, Read SH, McCarthy LM, Giannakeas V, Wu W, Strauss R, Wang X, Chen S, Gurwitz JH. Association of a calcium channel blocker and diuretic prescribing cascade with adverse events: a population-based cohort study. *J Am Geriatr Soc*. 2024 Feb;72(2):467-478. <https://pubmed.ncbi.nlm.nih.gov/38009803/>.
63. Gionfriddo MR, Duboski V, Middernacht A, Kern MS, Graham J, Wright EA. A mixed methods evaluation of medication reconciliation in the primary care setting. *PLoS One*. 2021 Dec 2;16(12):e0260882. <https://pubmed.ncbi.nlm.nih.gov/34855888/>.
64. Belda-Rustarazo S, Cantero-Hinojosa J, Salmeron-García A, González-García L, Cabeza-Barrera J, Galvez J. Medication reconciliation at admission and discharge: an analysis of prevalence and associated risk factors. *Int J Clin Pract*. 2015 Nov;69(11):1268-1274. <https://pubmed.ncbi.nlm.nih.gov/26202091/>.
65. Burnes D, Sheppard C, Henderson CR Jr, Wassel M, Cope R, Barber C, Pillemer K. Interventions to reduce ageism against older adults: a systematic review and meta-analysis. *Am J Public Health*. 2019 Aug;109(8):e1-e9. <https://pubmed.ncbi.nlm.nih.gov/31219720/>.
66. Levy BR, Banaji MR. Implicit ageism. In: Nelson TD, ed. *Ageism: Stereotyping and Prejudice Against Older Persons*. Cambridge, MA: The MIT Press; 2002.
67. Ayalon L, Tesch-Römer C. Introduction to the section: ageism—concept and origins. In: Ayalon L, Tesch-Römer C, eds. *Contemporary Perspectives on Ageism. International Perspectives on Aging*, vol.19. Cham, Switzerland: Springer; 2018. pp. 1-10. <https://doi.org/10.1007/978-3-319-73820-8>.
68. Cassel C, Fulmer T. Achieving diagnostic excellence for older patients. *JAMA*. 2022 Mar 8;327(10):919-920. <https://pubmed.ncbi.nlm.nih.gov/35175301/>.
69. Geriatric Emergency Department Collaborative (GEDC). GEDC Webinar Recording: Reframing Aging in the Geriatric Emergency Department. May 15, 2023. <https://gedcollaborative.com/event/aging-in-the-geriatric-ed/>.
70. Robb C, Chen H, Haley WE. Ageism in mental health and health care: a critical review. *J Clin Geropsychol*. 2002 Jan;8(1):1-12. <https://doi.org/10.1023/A:1013013322947>.

71. Graber ML, Franklin N, Gordon R. Diagnostic error in internal medicine. *Arch Intern Med.* 2005 Jul 11;165(13):1493-1499. <https://pubmed.ncbi.nlm.nih.gov/16009864/>.
72. Gandhi TK, Kachalia A, Thomas EJ, Puopolo AL, Yoon C, Brennan TA, Studdert DM. Missed and delayed diagnoses in the ambulatory setting: a study of closed malpractice claims. *Ann Intern Med.* 2006 Oct 3;145(7):488-496. <https://pubmed.ncbi.nlm.nih.gov/17015866/>.
73. Kishi Y, Kato M, Okuyama T, Hosaka T, Mikami K, Meller W, Thurber S, Kathol R. Delirium: patient characteristics that predict a missed diagnosis at psychiatric consultation. *Gen Hosp Psychiatry.* 2007 Sep-Oct;29(5):442-445. <https://pubmed.ncbi.nlm.nih.gov/17888812/>.
74. Tsui C, Kim K, Spencer M. The diagnosis “failure to thrive” and its impact on the care of hospitalized older adults: a matched case-control study. *BMC Geriatr.* 2020 Feb 14;20(1):62. <https://pubmed.ncbi.nlm.nih.gov/32059639/>.
75. Saukko PM, Rousham EK. Diagnosis between chaos and control: affect and hospital clinicians’ and older adult patients’ narratives of urinary tract infections. *Front Sociol* 2020 Aug 12;5:57. <https://pubmed.ncbi.nlm.nih.gov/33869463/>.
76. Rousham E, Cooper M, Petherick E, Saukko P, Oppenheim B. Overprescribing antibiotics for asymptomatic bacteriuria in older adults: a case series review of admissions in two UK hospitals. *Antimicrob Resist Infect Control.* 2019 May;8(1):71. <https://pubmed.ncbi.nlm.nih.gov/31073402/>.
77. Mayne S, Bowden A, Sundvall P-D, Gunnarsson R. The scientific evidence for a potential link between confusion and urinary tract infection in the elderly is still confusing: a systematic literature review. *BMC Geriatr.* 2019 Feb 4;19(1):1-15. <https://pubmed.ncbi.nlm.nih.gov/30717706/>.
78. Burton LA, Price R, Barr KE, McAuley SM, Allen JB, Clinton AM, Phillips G, Marwick CA, McMurdo ME, Witham MD. Hospital-acquired pneumonia incidence and diagnosis in older patients. *Age Ageing.* 2016 Jan;45(1):171-174. <https://pubmed.ncbi.nlm.nih.gov/26683049/>.
79. Gupta AB, Flanders SA, Petty LA, Gandhi TN, Pulia MS, Horowitz JK, Ratz D, Bernstein SJ, Malani AN, Patel PK, Hofer TP, Basu T, Chopra V, Vaughn VM. Inappropriate diagnosis of pneumonia among hospitalized adults. *JAMA Intern Med.* 2024 May 1;184(5):548-556. <https://pubmed.ncbi.nlm.nih.gov/38526476/>.
80. Bergl PA, Wijesekera TP, Nassery N, Cosby KS. Controversies in diagnosis: contemporary debates in the diagnostic safety literature. *Diagnosis (Berl).* 2020 Jan 28;7(1):3-9. <https://pubmed.ncbi.nlm.nih.gov/31129651/>.
81. Hoffman JR, Carpenter CR. Guarding against overtesting, overdiagnosis, and overtreatment of older adults: thinking beyond imaging and injuries to weigh harms and benefits. *J Am Geriatr Soc.* 2017 May;65(5):903-905. <https://pubmed.ncbi.nlm.nih.gov/28170085/>.
82. Rozbroj T, Haas R, O’Connor D, Carter SM, McCaffery K, Thomas R, Donovan J, Buchbinder R. How do people understand overtesting and overdiagnosis? Systematic review and meta-synthesis of qualitative research. *Soc Sci Med.* 2021 Sep;285:114255. <https://pubmed.ncbi.nlm.nih.gov/34391966/>.
83. Kotwal AA, Schonberg MA. Cancer screening in the elderly: a review of breast, colorectal, lung, and prostate cancer screening. *Cancer J.* 2017 Jul/Aug;23(4):246-253. <https://pubmed.ncbi.nlm.nih.gov/28731949/>.
84. Eckstrom E, Feeny DH, Walter LC, Perdue LA, Whitlock EP. Individualizing cancer screening in older adults: a narrative review and framework for future research. *J Gen Intern Med.* 2013 Feb;28(2):292-298. <https://pubmed.ncbi.nlm.nih.gov/23054920/>.

85. Kotwal AA, Walter LC. Cancer screening among older adults: a geriatrician's perspective on breast, cervical, colon, prostate, and lung cancer screening. *Curr Oncol Rep.* 2020 Aug 15;22(11):108. <https://pubmed.ncbi.nlm.nih.gov/32803486/>.
86. Kotwal AA, Walter LC. Cancer screening in older adults: individualized decision-making and communication strategies. *MedClin North Am.* 2020 Nov;104(6):989-1006. <https://pubmed.ncbi.nlm.nih.gov/33099456/>.
87. Fabrikant MS, Wisnivesky JP, Marron T, Taioli E, Veluswamy RR. Benefits and challenges of lung cancer screening in older adults. *Clin Ther.* 2018 Apr;40(4):526-534. <https://pubmed.ncbi.nlm.nih.gov/29573852/>.
88. Gilfillan R, Berwick DM. Medicare Advantage, Direct Contracting, and the Medicare 'Money Machine', Part 1: The Risk-Score Game. *Health Affairs Forefront.* 2021 Sep 29. <https://www.healthaffairs.org/content/forefront/medicare-advantage-direct-contracting-and-medicare-money-machine-part-1-risk-score-game>.
89. Schuff-Werner P. Challenges of laboratory diagnostics in the elderly. *J Lab Med.* 2018;423(4):105-107. <https://doi.org/10.1515/labmed-2018-0087>.
90. Bilsen MP, Aantjes MJ, van Andel E, Stalenhoef JE, van Nieuwkoop C, Leyten EMS, Delfos NM, Sijbom M, Numans ME, Achterberg WP, Mooijaart SP, van der Beek MT, Cobbaert CM, Conroy SP, Visser LG, Lambregts MMC. Current pyuria cutoffs promote inappropriate urinary tract infection diagnosis in older women. *Clin Infect Dis.* 2023 Jun 16;76(12):2070-2076. <https://pubmed.ncbi.nlm.nih.gov/36806580/>.
91. Risch M, Sakem B, Risch L, Nydegger UE. The SENIORLAB study in the quest for healthy elderly patients. *J Lab Med.* 2018 Jul 30;42(4):109-120. <https://doi.org/10.1515/labmed-2018-0034>.
92. Röhrig G, Becker I, Gutensohn K, Nebe T and on behalf of the Working Group Laboratory Diagnostics of the German Society of Hematology and Oncology and the Working Group Anemia in the Aged of the German Geriatric Society. Red blood cell counts and indices in the elderly German population. *J Lab Med.* 2018 Jul 25;42(4):131-139. <https://doi.org/10.1515/labmed-2017-0080>.
93. Calf AH, Pouw MA, van Munster BC, Burgerhof JGM, de Rooij SE, Smidt N. Screening instruments for cognitive impairment in older patients in the emergency department: a systematic review and meta-analysis. *Age Ageing.* 2021 Jan 8;50(1):105-112. <https://pubmed.ncbi.nlm.nih.gov/33009909/>.
94. Pinto TCC, Machado L, Bulgacov TM, Rodrigues-Júnior AL, Costa MLG, Ximenes RCC, Sougey EB. Is the Montreal Cognitive Assessment (MoCA) screening superior to the Mini-Mental State Examination (MMSE) in the detection of mild cognitive impairment (MCI) and Alzheimers Disease (AD) in the elderly? *Int Psychogeriatr.* 2019 Apr;31(4):491-504. <https://pubmed.ncbi.nlm.nih.gov/30426911/>.
95. Benedetti A, Wu Y, Levis B, Wilchesky M, Boruff J, Ioannidis JPA, Patten SB, Cuijpers P, Shrier I, Gilbody S, Ismail Z, McMillan D, Mitchell N, Ziegelstein RC, Thombs BD. Diagnostic accuracy of the Geriatric Depression Scale-30, Geriatric Depression Scale-15, Geriatric Depression Scale-5, and Geriatric Depression Scale-4 for detecting major depression: protocol for a systematic review and individual participant data meta-analysis. *BMJ Open.* 2018 Dec 4;8(12):e026598. <https://pubmed.ncbi.nlm.nih.gov/30518594/>.
96. Krishnamoorthy Y, Rajaa S, Rehman T. Diagnostic accuracy of various forms of geriatric depression scale for screening of depression among older adults: systematic review and meta-analysis. *Arch Gerontol Geriatr.* 2020 Mar-Apr; 87:104002. <https://pubmed.ncbi.nlm.nih.gov/31881393/>.

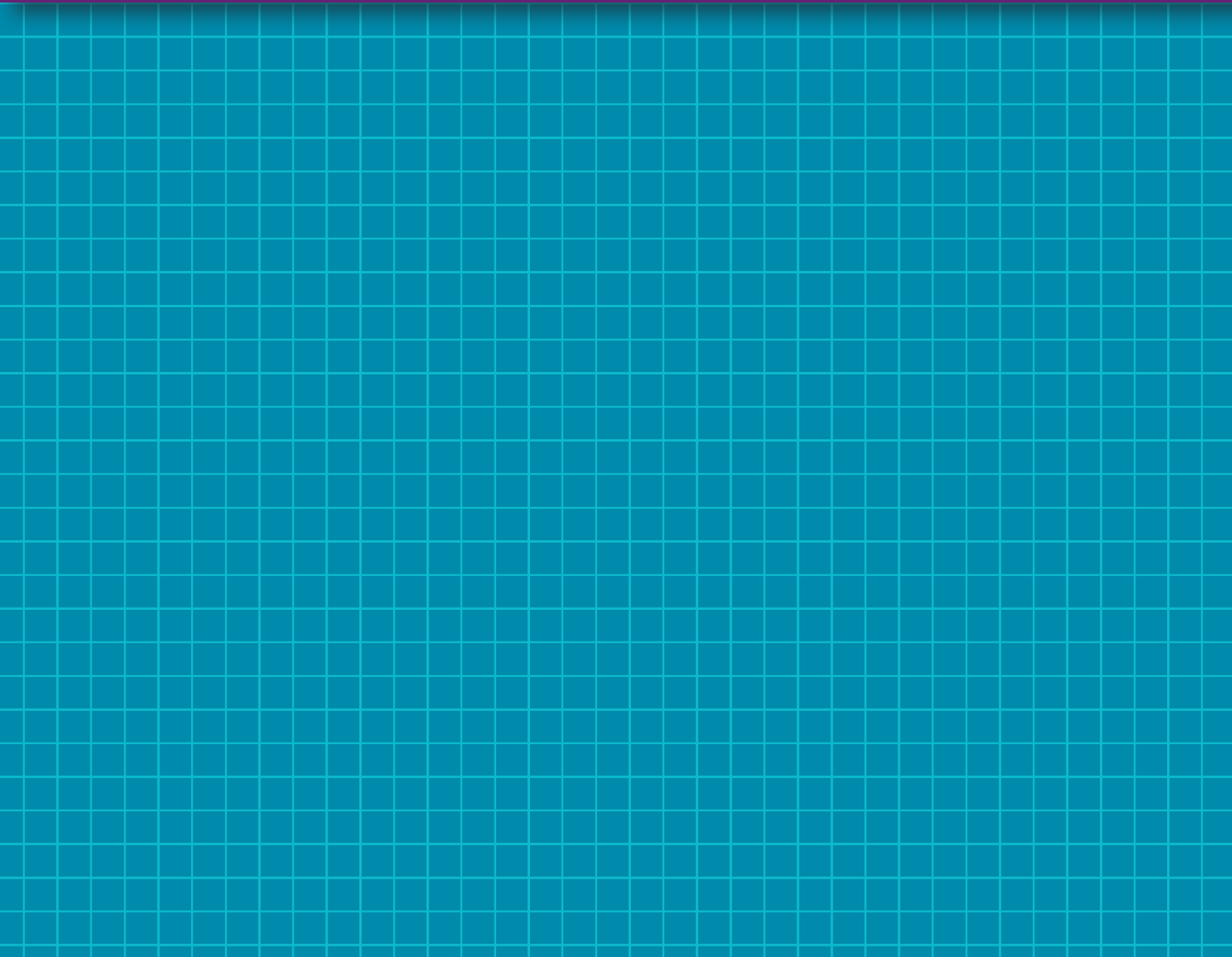
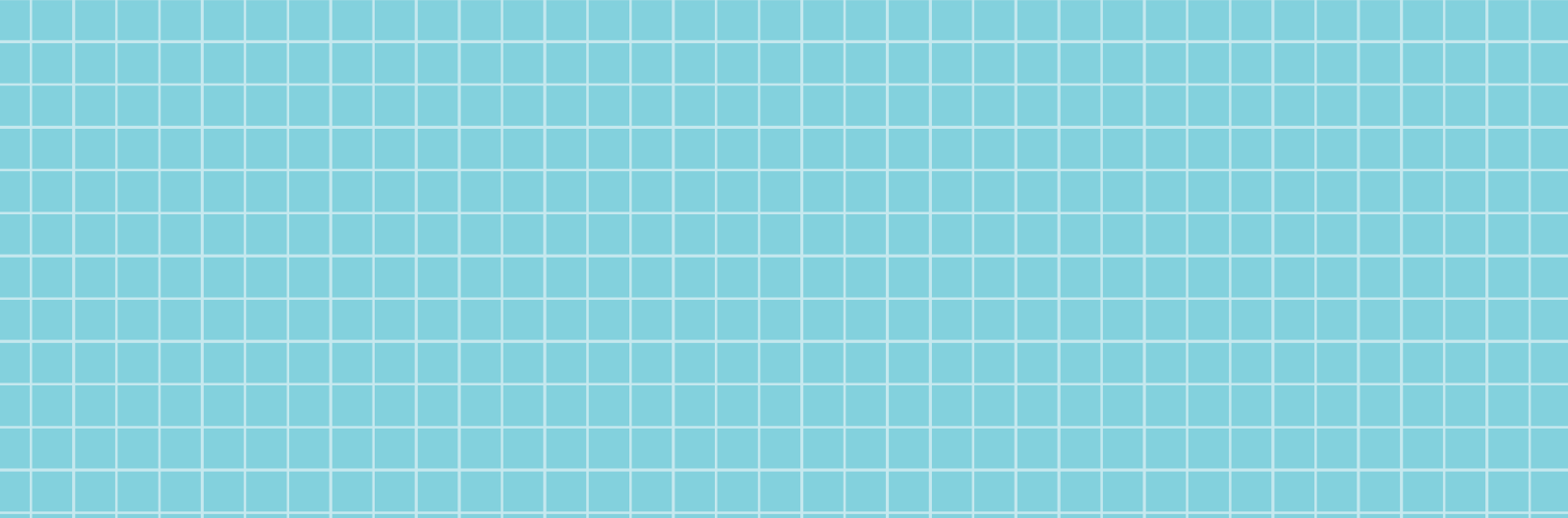
97. Pocklington C, McMillan D, Gilbody S, Manea L. The diagnostic accuracy of brief and ultra-brief versions of the Geriatric Depression Scale: a meta-analysis. *Eur Psychiatry*. 2015 Mar;30(Suppl 1):1437. [https://doi.org/10.1016/S0924-9338\(15\)31111-1](https://doi.org/10.1016/S0924-9338(15)31111-1).
98. Huang EY, Lam SC. Review of frailty measurement of older people: evaluation of the conceptualization, included domains, psychometric properties, and applicability. *Aging Med (Milton)*. 2021 Sep 19;4(4):272-291. <https://pubmed.ncbi.nlm.nih.gov/34964008/>.
99. Kim S, Kim M, Jung H-W, Won CW. Development of a frailty phenotype questionnaire for use in screening community-dwelling older adults. *J Am Med Dir Assoc*. 2020 May;21(5):660-664. <https://pubmed.ncbi.nlm.nih.gov/31672563/>.
100. Fontes R, dos Santos Teixeira PdF, Vaisman M. Screening of undiagnosed hypothyroidism in elderly persons with diabetes according to age-specific reference intervals for serum thyroid stimulating hormone and the impact of antidiabetes drugs. *J Diabetes Res*. 2016;2016:1417408. <https://pubmed.ncbi.nlm.nih.gov/27403442/>.
101. Ohnishi Y, Watanuki S. The definition and evaluation of uncoordinated involvement of multiple healthcare providers; “polydoctoring” as a component of care fragmentation among patients with multimorbidity. *J Gen Fam Med*. 2024 Jan 13;25(2):114-115. <https://pubmed.ncbi.nlm.nih.gov/38481742/>.
102. Romano MJ, Segal JB, Pollack CE. The association between continuity of care and the overuse of medical procedures. *JAMA Intern Med*. 2015 Jul;175(7):1148-1154. <https://pubmed.ncbi.nlm.nih.gov/25984883/>.
103. Kern LM, Seirup JK, Casalino LP, Safford MM. Healthcare fragmentation and the frequency of radiology and other diagnostic tests: a cross-sectional study. *J Gen Intern Med*. 2017 Feb;32(2):175-181. <https://pubmed.ncbi.nlm.nih.gov/27796694/>.
104. Haggerty JL, Reid RJ, Freeman GK, Starfield BH, Adair CE, McKendry R. Continuity of care: a multidisciplinary review. *BMJ*. 2003 Nov 22;327(7425):1219-1221. <https://pubmed.ncbi.nlm.nih.gov/14630762/>.
105. van Walraven C, Oake N, Jennings A, Forster AJ. The association between continuity of care and outcomes: a systematic and critical review. *J Eval Clin Pract*. 2010 Oct;16(5):947-956. <https://pubmed.ncbi.nlm.nih.gov/20553366/>.
106. Stroupe KT, Nazi K, Hogan TP, Poggensee L, Wakefield B, Martinez RN, Etingen B, Shimada S, Suda KJ, Huo Z, Cao L, Smith BM. Web-based patient portal use and medication overlap from VA and private-sector pharmacies among older veterans. *J Manag Care Spec Pharm*. 2021 Aug;27(8):983-994. <https://pubmed.ncbi.nlm.nih.gov/34337984/>.
107. Schleiden LJ, Thorpe CT, Cashy JP, Gellad WF, Good CB, Hanlon JT, Mor MK, Niznik JD, Pleis JR, Van Houtven CH, Thorpe JM. Characteristics of dual drug benefit use among veterans with dementia enrolled in the Veterans Health Administration and Medicare Part D. *Res Social Adm Pharm*. 2019 Jun;15(6):701-709. <https://pubmed.ncbi.nlm.nih.gov/30236896/>.
108. Rajan M, Helmer D, Rowneki M, Fried D, Kern LM. Ambulatory care fragmentation and hospitalization among veterans with diabetes. *Am J Manag Care*. 2021;27(4):155-160. <https://doi.org/10.37765/ajmc.2021.88509>.
109. American Geriatrics Society. Why Geriatrics. 2024. <https://www.americangeriatrics.org/geriatrics-profession/why-geriatrics>.

110. Rowe JW. The U.S. eldercare workforce is falling further behind. *Nature Aging*. 2021;1(4):327-329. <https://doi.org/10.1038/s43587-021-00057-z>.
111. Auerbach DI, Buerhaus PI, Staiger DO. Implications of the rapid growth of the nurse practitioner workforce in the U.S. *Health Aff (Millwood)*. 2020;39(2):273-279. <https://www.healthaffairs.org/doi/10.1377/hlthaff.2019.00686>.
112. Bor JS. Among the elderly, many mental illnesses go undiagnosed. *Health Aff (Millwood)*. 2015;34(5):727-731. <https://www.healthaffairs.org/doi/10.1377/hlthaff.2015.0314>
113. Committee on the Mental Health Workforce for Geriatric Populations; Board on Health Care Services; Institute of Medicine. Eden J, Maslow K, Le M, Blazer D, eds. *The Mental Health and Substance Use Workforce for Older Adults: In Whose Hands?* Washington, DC: National Academies Press; 2012. <https://www.ncbi.nlm.nih.gov/books/NBK201410/>.
114. Bartels SJ, Naslund JA. The underside of the silver tsunami: older adults and mental health care. *N Engl J Med*. 2013 Feb 7;368(6):493-496. <https://pubmed.ncbi.nlm.nih.gov/23343039/>.
115. McCarthy D, Waugh L, Nong P. Living Independently With GRACE: The Geriatric Resources for Assessment and Care of Elders Model. <https://www.commonwealthfund.org/publications/case-study/2021/oct/living-independently-grace>.
116. Counsell SR, Callahan CM, Tu W, Stump TE, Arling GW. Cost analysis of the Geriatric Resources for Assessment and Care of Elders care management intervention. *J Am Geriatr Soc*. 2009 Aug;57(8):1420-1426. <https://pubmed.ncbi.nlm.nih.gov/19691149/>.
117. National PACE Association. What Is PACE Care? <https://www.npaonline.org/what-is-pace-care>.
118. Fulmer T. *Discovering the 4Ms: A Framework for Creating Age-Friendly Health Systems*. New York, NY: John A. Hartford Foundation; August 7, 2018. <https://www.johnahartford.org/blog/view/discovering-the-4ms-a-framework-for-creating-age-friendly-health-systems/>.
119. American College of Emergency Physicians. Geriatric Emergency Department Accreditation Program. <https://www.acep.org/geda/>.
120. Kennedy M, Lesser A, Israni J, Liu SW, Santangelo I, Tidwell N, Southerland LT, Carpenter CR, Biese K, Ahmad S, Hwang U. Reach and adoption of a geriatric emergency department accreditation program in the United States. *Ann Emerg Med*. 2022;79(4):367-373. <https://pubmed.ncbi.nlm.nih.gov/34389196/>.
121. Gettel CJ, Hwang U, Janke AT, Rothenberg C, Tomasino DF, Schneider SM, Goyal P, Venkatesh AK. An outcome comparison between geriatric and nongeriatric emergency departments. *Ann Emerg Med*. 2023;82(6):681-689. <https://pubmed.ncbi.nlm.nih.gov/37389490/>.
122. Association of Directors of Geriatrics Academic Programs [ADGAP]. Minimum Geriatric Competencies for Medical Students. 2021. <https://adgap.americangeriatrics.org/education-training/competencies/geriatrics-competencies-medical-students>.
123. Sharkiya SH. Quality communication can improve patient-centred health outcomes among older patients: a rapid review. *BMC Health Serv Res*. 2023 Aug 22;23(1):886. <https://pubmed.ncbi.nlm.nih.gov/37608376/>.
124. Shen MJ, Manna R, Banerjee SC, Nelson CJ, Alexander K, Alici Y, Gangai N, Parker PA, Korc-Grodzicki B. Incorporating shared decision making into communication with older adults with cancer and their caregivers: development and evaluation of a geriatric shared decision-making communication skills training module. *Patient Educ Couns*. 2020 Nov;103(11):2328-2334. <https://pubmed.ncbi.nlm.nih.gov/32475710/>.

125. Wolff JL, Scerpella D, Cockey K, Hussain N, Funkhouser T, Echavarria D, Aufill J, Guo A, Sloan DH, Dy SM, Smith KM; SHARING Choices Investigators. SHARING Choices: a pilot study to engage family in advance care planning of older adults with and without cognitive impairment in the primary care context. *Am J Hosp Palliat Care*. 2021 Nov;38(11):1314-1321. <https://pubmed.ncbi.nlm.nih.gov/33325729/>.
126. Agency for Healthcare Research and Quality. Toolkit for Engaging Patients To Improve Diagnostic Safety. Be The Expert On You. <https://www.ahrq.gov/patient-safety/settings/ambulatory/tools/diagnostic-safety/toolkit.html>. Content last reviewed July 2022.
127. Institute for Healthcare Improvement. My Health Checklist. 2024. <https://www.ihl.org/my-health-checklist#:~:text=My%20Health%20Checklist%20is%20designed,and%20your%20questions%20or%20concerns>.
128. Masot O, Cox A, Mold F, Sund-Levander M, Tingström P, Boersema GC, Botigué T, Daltrey J, Hughes K, Mayhorn CB, Montgomery A, Mullan J, Carey N. Decision support-tools for early detection of infection in older people (aged > 65 years): a scoping review. *BMC Geriatrics*. 2022 Jul 1;22(1):552. <https://pubmed.ncbi.nlm.nih.gov/35778707/>.
129. Agency for Healthcare Research and Quality. Special Emphasis Notice: AHRQ Announces Interest in Health Services Research To Improve Care Delivery, Access, Quality, Equity, and Health Outcomes for Older Adults. May 13, 2024. <https://grants.nih.gov/grants/guide/notice-files/NOT-HS-24-013.html>.
130. National Alliance for Caregiving and AARP. Caregiving in the U.S. 2020 Report. Washington, DC: AARP; May 2020. <https://www.aarp.org/content/dam/aarp/ppi/2020/05/full-report-caregiving-in-the-united-states.doi.10.26419-2Fppi.00103.001.pdf>.
131. Committee on Family Caregiving for Older Adults, Board on Health Care Services, Health and Medicine Division, National Academies of Sciences, Engineering, and Medicine; Schulz R, Eden J, eds. Families Caring for an Aging America. Washington, DC: National Academies Press; 2016 Nov 8. Summary. <https://www.ncbi.nlm.nih.gov/books/NBK396392/>.
132. Riffin C, Patrick K, Lin SL, Carrington Reid M, Herr K, Pillemer KA. Caregiver–provider communication about pain in persons with dementia. *Dementia (London)*. 2022 Jan;21(1):270-286. <https://pubmed.ncbi.nlm.nih.gov/34340587/>.
133. Demiris G, Ganz FD, Han CJ, Pike K, Oliver DP, Washington K. Design and preliminary testing of the caregiver-centered communication questionnaire (CCCQ). *J Palliat Care*. 2020 Jul;35(3):154-160. <https://pubmed.ncbi.nlm.nih.gov/31696787/>.
134. Martínez-Alcalá CI, Pliego-Pastrana P, Rosales-Lagarde A, Lopez-Noguerola JS, Molina-Trinidad EM. Information and communication technologies in the care of the elderly: systematic review of applications aimed at patients with dementia and caregivers. *JMIR Rehabil Assist Technol*. 2016 May;3(1):e6. <https://pubmed.ncbi.nlm.nih.gov/28582258/>.
135. Oostra DL, Fierkens C, Alewijnse MEJ, Olde Rikkert MGM, Nieuwboer MS, Perry M. Implementation of interprofessional digital communication tools in primary care for frail older adults: an interview study. *J Interprof Care*. 2023 May-Jun;37(3):362-370. <https://pubmed.ncbi.nlm.nih.gov/35862572/>.
136. Wittenberg E, Ferrell B, Goldsmith J, Ruel NH. Family Caregiver Communication Tool: a new measure for tailoring communication with cancer caregivers. *Psychooncology*. 2017 Aug;26(8):1222-1224. <https://pubmed.ncbi.nlm.nih.gov/27530695/>.

137. Latulipe C, Quandt SA, Melius KA, Bertoni A, Miller DP Jr, Smith D, Arcury TA. Insights into older adult patient concerns around the caregiver proxy portal use: qualitative interview study. *J Med Internet Res*. 2018 Nov;20(11):e10524. <https://pubmed.ncbi.nlm.nih.gov/30389654/>.
138. Burgdorf JG, Fabius CD, Wolff JL. Use of provider-sponsored patient portals among older adults and their family caregivers. *J Am Geriatr Soc*. 2023 Apr;71(4):1177-1187. <https://pubmed.ncbi.nlm.nih.gov/36573382/>.
139. Burgdorf J, Fabius C, Wolff J. Patient portal use within older adults' family caregiving networks. *Innov Aging*. 2022 Nov;6(Suppl1):374-374. <https://doi.org/10.1093/geroni/igac059.1476>.
140. Bratches RWR, Wall JA, Puga F, Pilonieta G, Jablonski R, Bakitas M, Geldmacher DS, Odom JN. Patient portal use among family caregivers of individuals with dementia and cancer: regression analysis from the National Study of Caregiving. *JMIR Aging*. 2023 Dec 20;6:e44166. <https://pubmed.ncbi.nlm.nih.gov/38235767/>.
141. Giguere AMC, Lawani MA, Fortier-Brochu É, Carmichael PH, Légaré F, Kröger E, Wittman HO, Voyer P, Caron D, Rodríguez C. Tailoring and evaluating an intervention to improve shared decision-making among seniors with dementia, their caregivers, and healthcare providers: study protocol for a randomized controlled trial. *Trials*. 2018 Jun 25;19(1):332. <https://pubmed.ncbi.nlm.nih.gov/29941020/>.
142. Lakin JR, Brannen EN, Tulskey JA, Paasche-Orlow MK, Lindvall C, Chang Y, Gundersen DA, El-Jawahri A, Volandes A; ACP-PEACE Investigators. Advance Care Planning: Promoting Effective and Aligned Communication in the Elderly (ACP-PEACE): the study protocol for a pragmatic stepped-wedge trial of older patients with cancer. *BMJ Open*. 2020 Jul 14 ;10(7):e040999. <https://pubmed.ncbi.nlm.nih.gov/32665394/>.
143. Patient Safety and Quality Improvement Act of 2005. 42 U.S.C. §§ 299b-21–299b-26. <https://uscode.house.gov/view.xhtml?path=/prelim@title42/chapter6A/subchapter7/partC&edition=prelim>.
144. Agency for Healthcare Research and Quality. About the PSO Program. <https://pso.ahrq.gov/about>. Page last reviewed October2020.
145. Bender FF. “I’m sorry” laws and medical liability. *AMA J Ethics*. 2007 Apr;9(4):300-304. <https://journalofethics.ama-assn.org/article/im-sorry-laws-and-medical-liability/2007-04>.
146. Linzer M, Bitton A, Tu SP, Plews-Ogan M, Horowitz KR, Schwartz MD; Association of Chiefs and Leaders in General Internal Medicine Writing Group: Poplau S, Paranjape A, Landry M, Babbott S, Collins T, Caudill TS, Prasad A, Adolphe A, Kern DE, Aung K, Benschung K, Fairfield K. The end of the 15-20 minute primary care visit. *J Gen Intern Med*. 2015 Nov;30(11):1584-1586. <https://pubmed.ncbi.nlm.nih.gov/25900539/>.
147. National Academies of Sciences, Engineering, and Medicine; Health and Medicine Division; Board on Health Care Services; Committee on Implementing High-Quality Primary Care, Robinson SK, Meisnere M, Phillips RL Jr., McCauley, eds. *Implementing High-Quality Primary Care: Rebuilding the Foundation of Healthcare*. Washington, DC: National Academies Press; 2021. <https://www.ncbi.nlm.nih.gov/books/NBK571810/>.
148. The John A. Hartford Foundation. CMS Measures Under Consideration: Public Comment Invited on Age-Friendly Hospital Measure. December 12, 2023. <https://www.johnahartford.org/dissemination-center/view/cms-proposed-rule-public-comment-invited-on-age--friendly-hospital-measure>.

149. Department of Veterans Affairs. Geriatric Nurse Practitioner Residency. Content last updated May 8, 2024. <https://www.va.gov/northeast-ohio-health-care/work-with-us/internships-and-fellowships/geriatric-nurse-practitioner-residency/#:~:text=The%20Geriatric%20Nurse%20Practitioner%20Residency,and%20national%20resources%20and%20consultations>.
150. Health Resources and Services Administration. Geriatric Workforce Enhancement Program (GWEP) Awardees. Last reviewed June 2024. <https://bhw.hrsa.gov/funding/apply-grant/gwep-awardees>.
151. Centers for Medicare & Medicaid Services. Meaningful Measures Initiative Webinar. <https://www.cms.gov/files/document/meaningful-measures-webinar-transcript-remediatedpdf>.



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