## Introduction to pain

Pain is a fundamental part of being human. It acts as a signal, alerting us to potential or real tissue damage, and it could make us remember the unpleasantness associated with the pain to prevent us from repeated damage. Physiologically, nociceptors (sensory nerve endings) come into contact with a painful or noxious stimulus, nerve impulse travels from the sensory nerve endings to the spinal cord where the impulse is rapidly shunted to the brain via nerve tracts in the spinal cord and brainstem, and finally the pain sensation is processed in the brain to trigger quick motor response in an attempt to halt the action causing the pain (Figure 1).

Figure 1: Brain regions involved in the ascending (pain) pathway
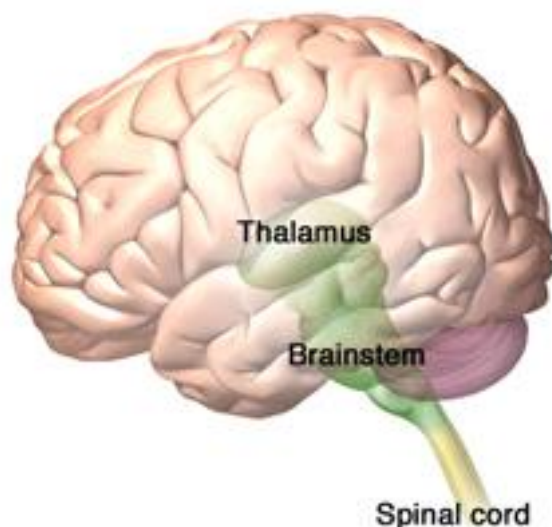
Adapted from: https://www.atrainceu.com/content/4-physiology-pain [Accessed 12 January 2021]

Clinically, pain is categorised into three types:
  (1) **Acute Pain**, which describes a short-term pain, such as a sprained ankle,
  (2) **Persistent** or **Chronic Pain**, which describes a long-term pain, such as back ache or arthritis and
  (3) **Recurrent** or **Intermittent Pain**, which describes pain that comes and goes, such as a tooth ache.

Chronic pain is defined as the pain that lasts for three months or more than normal healing time[1]. While acute pain alerts us that something is wrong in our body, chronic pain often serves no useful purpose and can have significant impact on one's life. As people are living longer than ever, this has meant that more people are living more years of chronic illness and pain, with chronic pain affecting up to 50% of the world's elderly population, although this is likely to be an underestimate[2]. Elderly people are particularly vulnerable to chronic pain as they are more likely to suffer from multiple age-related conditions, contributing to significant suffering, disability, and social isolation[3].

To complicate the matter, pain levels are difficult to assess, especially for people with dementia (PWD) or cognitive impairment. A range of new assessment tools are available for this population, but there is no standardised tool or approach for assessing pain in PWD or people with cognitive impairment[5]. However, until there is an agreed approach to ensure

accurate assessment of pain, the presence of pain will continue to be overlooked, underestimated, and thus, improperly treated, particularly in those experiencing pain at the end of life. Accurate detection and quantification of pain in those with no effective means to communicate the pain to others is an unmet need that urgently needs to be addressed.

In this essay, the burden of chronic pain will be discussed in the context of aging population. Then the link between aging and chronic pain will be explored, providing potential explanations for challenges in assessing chronic pain in elderly population. In the later sections, the importance of early and accurate detection to facilitate effective management for chronic pain will be discussed.

Global burden of chronic pain in aging population

Chronic pain is a growing global health issue. The World Health Organisation (WHO) estimates that one in five, or 1.5 billion people live with chronic pain. Global Burden of Disease Study place chronic pain conditions, such as lower back pain, neck pain, and osteoarthritis among the top contributors to years lived with disability (YLD) globally[6].

Chronic pain is associated with significant suffering, social isolation, disability, and greater costs and burden to the healthcare systems. The indirect economic impact of back pain in the UK, such as from absenteeism or poor productivity, is estimated to be between £5 billion and £10.7 billion. Painful conditions, such as arthritis and back pain account for one-third of all claims for disability benefits in the UK[9].

To address this growing burden, the WHO redefined chronic pain in 2017, acknowledging it as a disease in its own right, as well as a symptom that is secondary to an underlying disease. The new system will be included in upcoming International Classification of Disease (ICD)-11 in 2022, providing a single diagnostic code for chronic pain[1].
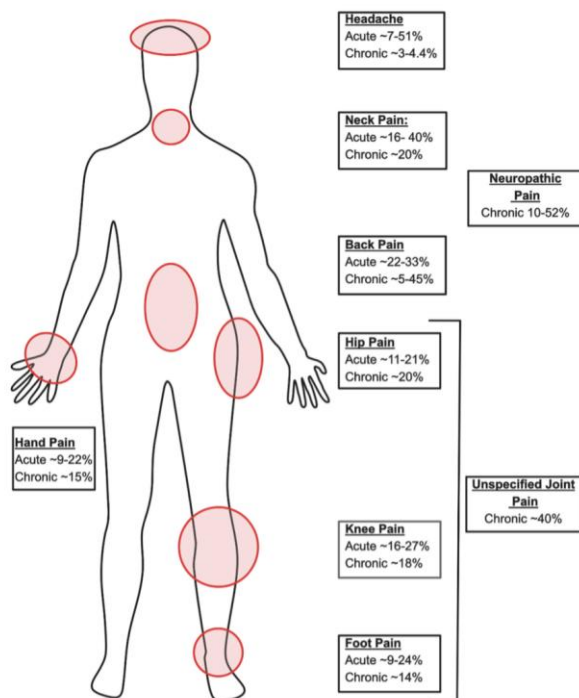
What impact could a new definition have? This revision and designation of appropriate diagnostic codes for chronic pain aims to promote governments to take a new interest in pain and how their health systems assess and treat it. The WHO's ICD is usually followed by governments, for instance when considering which services to fund, and therefore could lead to pain care services receiving more funding. Likewise, ICD also informs clinicians and researchers, to improve pain management and advance our understanding of pain. Therefore, this new classification marks a significant point in the direction of addressing the global burden of chronic pain on societies, health and economic systems[1].

Chronic pain in older adults

Chronic pain is more common and particularly problematic in older adults (age>65). According to one study, 38.5% of community-dwelling people over 60 experience regular pain, which higher than that in the adult population (19%) and schoolchildren (6%)[10]. While higher prevalence of chronic pain in older adults is well-recognised, it is thought to be substantially underestimated. As older adults are already more susceptible to being socially isolated and developing mental and physical disabilities than the younger counterparts, there is a growing demand for better chronic pain management particularly in this population.

Chronic pain is the primary reason older people visit hospitals or their GPs, most frequent of which are chronic lower back pain, chronic neck pain, as well as chronic pain in the hip and knee, affecting approximately 40, 55, and 20% respectively (figure 2)[3].

Figure 2: Prevalence of pain in adults aged 65 years or older by site of pain

Headache	Acute ~7-51%	Chronic ~3-4.4%
Neck Pain:	Acute ~16- 40%	Chronic ~20%
Neuropathic Pain	Chronic 10-52%	
Back Pain	Acute ~22-33%	Chronic ~5-45%
Hip Pain	Acute ~11-21%	Chronic ~20%
Hand Pain	Acute ~9-22%	Chronic ~15%
Unspecified Joint Pain	Chronic ~40%	
Knee Pain	Acute ~16-27%	Chronic ~18%
Foot Pain	Acute ~9-24%	Chronic ~14%

Adapted from: Domenichiello AF and Ramsden CE. The silent epidemic of chronic pain in older adults. Prog Neuropsychopharmacol Biol Psychiatry. 2019 July 13; 93: 284–290. doi:10.1016/j.pnpbp. 2019.04.006.

While site-specific pain and its impact on daily life can be alleviated by treating the location of the pain, for instance join replacement for knee pain, chronic pain is a condition in its own right with features across multiple sites over a prolonged period of time. This could therefore, have more serious consequences, such as reduced mobility and a resultant loss of strength, compromise the immune system, and interfere with person's ability to eat, concentrate, sleep or interact with others, to list a few[4].

Inability to perform activities of daily living could also reduce social functioning and quality of life (QoL). As the pain increases in chronicity, it may manifest into musculoskeletal problems, sleep disorders, falls, malnutrition, increased use of drugs, and depression[11]. All of these outcomes could have individual as well as societal impacts.

Chronic pain in older adults could also lead to cognitive impairment, which makes early detection and treatment particularly important. If an elderly patient already has a cognitive impairment, it could make chronic pain difficult to assess and therefore manage, for the reasons that will be discussed in the next sections of this essay.

What's different in older adults?

Many studies have postulated that the age-related decline in peripheral sensory system leads to increased pain threshold with age. While this may be true, chronic pain cannot be explained in the same way as acute pain. Acute pain is a sensory experience that alerts the body of possible tissue damage, while chronic pain is independent of pain threshold, by

definition. In chronic pain, there are changes in the spinal cord and the brain that change how we perceive painful sensations, and therefore, pain threshold (the minimum point at which a stimuli causes pain) is less relevant. Therefore, change in pain threshold with aging is unlikely to explain or predict susceptibility to developing chronic pain[4].

While pain threshold represents peripheral nervous system (PNS) sensory input, subjective experience of pain (or pain tolerance) is processed by the central nervous system (CNS) mechanisms, involving emotion and motivational circuits. Therefore, some studies propose that aging could affect the CNS and PNS pain circuitry in different ways, leading to the preserved or increased pain threshold (involving PNS circuitry), while pain tolerance or the maximum amount of pain you can handle (involving CNS circuitry) worsens. Neuroimaging studies support this and shows aging-associated decreases in activation of somatosensory (S1) cortex, medial insular cortex, and basal ganglia, parts of the CNS circuitry[4].

Overall, it is understood that pain may be experienced differentially in older adults and distinguishing the pain processing circuitries involved in acute and chronic pain is important as many treatments that solely target peripheral mechanisms are ineffective at treating chronic pain[4].

Chronic pain in people with dementia
The prevalence of chronic pain among people with cognitive problems is as high as 50% of people, according to an epidemiological analysis of community-dwelling residents and pain clinics[10]. One explanation for chronic pain being common in people with cognitive deficits is that chronic pain could hasten the process of cognitive decline, suggesting that pain and cognitive decline may have a shared mechanism[3]. In the Einstein Aging Study, which is one of the longest running prospective cohort studies of aging, 1114 elderly participants were assessed and 114 (10%) of the participants developed dementia over 4.4 years[12].

Moreover, the relationship between cognitive decline and pain is likely to be bidirectional, meaning that as memory becomes impaired, pain perception and processing could also become impaired. This poses a challenge in managing pain in this population as cognitive decline affects the ability to report pain, making it difficult to accurately assess pain, to make prompt treatment decisions[13].

What's different in dementia?
There are two areas of the brain thought to be involved in pain processing, based on the current theory. The lateral pain system projects through lateral thalamic nuclei to brain regions including the primary and secondary cortices (S1 and S2), and is thought to be involved in sensory aspect of pain (i.e. locating the pain). On the other hand, the medial pain system projects through medial thalamic nuclei to brain regions including the prefrontal and anterior cingulate cortices[14] and is thought to be involved in emotional or affective aspect of pain (i.e. experiencing unpleasantness).

It is thought that neuropathological changes that occur in dementia are primarily in the medial (affective-motivational) pathway rather than the lateral (sensory-discriminatory) pathway[15]. Why is this important? These findings could elucidate why PWD with chronic pain can present with change in behaviour, including agitation, anxiety, and vocalisation. These manifestations of pain in PWD are mistaken for patients "being difficult" and makes it commonplace for healthcare professionals (HCPs) to prescribe antipsychotics or sedatives, which is a dangerous approach as many of these drugs have serious side effects and could significantly impact on patients' QoL.

While pain perception in dementia is inconsistently reported, the current evidence points to the fact that PWD have altered experience of pain and that ability to express or describe pain is impaired. This is supported by multiple studies reporting improved sensitivity of pain assessment when facial assessment of pain response is used instead of the "gold standard" pain self-report measures[4].

Pain recognition may also be impaired in dementia. While the impact of impaired episodic memory (i.e. memories of specific events) in pain-reporting in dementia is well-reported, the effect of impaired semantic memory (i.e. wider factual conceptual knowledge) is less clear. In one study, the authors explained semantic memory is significantly impaired in PWD and that the concept of pain may no longer be intact in these patients, making it difficult for them to recognise what it is they are feeling, thereby leading to reduced pain reporting even when using a non-self-report measure[16].

Pain assessment in dementia

So far in this essay, I have discussed how chronic pain presents in older adults and dementia populations. For the remaining sections, challenges associated with assessing chronic pain in PWD will be explored.

Self-assessment scales are considered the "gold standard" for assessing pain in all populations, but it is commonly agreed that self-assessment measures cannot effectively assess pain in patients who are unable to understand the scale instructions and provide effective verbal response. Therefore, the presence of cognitive impairment decreases the measures' reliability as dementia impairs the ability to express the experience of pain[4]. This prompted the need for new measurement tools that do not rely on patients' abilities to communicate pain.

Over the past 10 years, there have been over 20 tools developed. While many are useful, it is now agreed that the most important consideration is not to find one most accurate tool, but to use multiple tools in combination as all of these tools are prone to limitations. As medics and HCPs, therefore, it is vital that we are educated on which tools and approaches to rely on in which patients, and to familiarise ourselves with multiple tools can support the assessment process. This will not only be useful in detecting pain, but also in evaluating and communicating pain with the healthcare team to guide quality pain management[4].

Pain Assessment in Advanced Dementia Scale (PAINAD), is a behavioural scale for assessing pain in PWD who are unable to self-report. PAINAD comprises of five domains; 1) breathing independent of vocalisation, 2) negative vocalisation (e.g. moaning or groaning), 3) facial expression (frightened or grimacing), 4) body language (e.g. tense or rigid), and 5) consolability (e.g. distracted or unable to distract/console) (Table 1)[17]. The current UK guidelines for assessment of pain in older people recommends the structured pain education for HCPs on the use of PAINAD tool[9]. Using such tool enables carers and family members to support early detection of pain and initiation of treatment in many settings, including the waiting room of a hospital emergency department[17].

Table 1: Pain Assessment in Advanced Dementia- PAINAD Tool

Pain Assessment IN Advanced Dementia- PAINAD Tool

ITEM	0	1	2	Score
Breathing independent of vocalization	Normal	Occasional labored breathing. Short period of hyperventilation	Noisy labored breathing. Long period of hyperventilation. Cheyne-stokes respirations	
Negative vocalization	None	Occasional moan or groan. Low-level of speech with a negative or disapproving quality	Repeated troubled calling out. Loud moaning or groaning. Crying.	
Facial expression	Smiling or inexpressive	Sad, frightened, frown	Facial grimacing	
Body language	Relaxed	Tense. Distressed pacing. Fidgeting	Rigid. Fists clenched. Knees pulled up. Pulling or pushing away. Striking out	
Consolability	No need to console	Distracted or reassured by voice or touch	Unable to console, distract or reassure	
TOTAL*				

* Total scores range from 0 to 10 (based on a scale of 0 to 2 for five items), with a higher score indicating more severe pain (0="no pain" to 10="severe pain")

Adapted from "https://geriatricpain.org/assessment/cognitively-impaired/painad/pain-assessment-advanced-dementia-painad-tool [Accessed 12.01.2021]"

Simple tools like these also facilitates multidisciplinary care for patients, by ensuring effective and standardised communication, and acts as a prompt for HCPs to assess for the key behavioural domains and signs associated with pain in PWD[17]. Furthermore, it could prevent a potential diagnostic shadowing, where patients could be assumed to have "just dementia" and denied pain treatment and adequate care[4]. Training in such pain assessment tools is important, as patients with severe stages of dementia, where verbal expression can be significantly impaired, behaviour could be the primary way of communication.

Summary & Recommendations

Aging population continues to put pressure on healthcare systems globally. Chronic pain accounts for significant proportion of healthcare spending on an individual-level as well as on a system-level, and the disease burden will continue to grow with the demographic changes.

In order to tackle this public health problem, we must promote for better awareness and behavioural change within the healthcare community to recognise chronic pain when we encounter them. As pain management moves towards multidisciplinary approach, pain assessment must also adapt to be used by different professionals, in different settings and systems. This will not only guide management of individual patients, but will facilitate research and policy development, which would ultimately drive systemic improvement in pain management.

Chronic pain, particularly in older adults and those living with dementia, must be acknowledged as more than "just pain" or "difficult behaviour". When the concept of "pain" is forgotten, or when pain is intertwined with mental and physical health comorbidities, the consequences could be lethal. In light of limited efficacy and safety profile data available on current pain-relieving treatments on older adults, early pain detection and secondary prevention of pain may help improve quality of life of older adults and PWD suffering with

chronic pain. Effective management starts with effective assessment. Without better detection of pain, we are neglecting the very population that need help the most.

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