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NATIONAL UNIVERSITY OF PHARMACY
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QUALIFICATION WORK

on the topic: « **STUDY OF CURRENT APPROACHES TO PHARMACEUTICAL CARE IN THE MANAGEMENT OF NEUROPATHIC PAIN IN ELDERLY PATIENTS»**

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Kharkiv – 2025

ANNOTATION

This qualification work examines current approaches to pharmaceutical care in the management of neuropathic pain (NP) in elderly patients. It reviews international literature on the prevalence, pathophysiology and classification of NP in older adults, analyzes evidence-based treatment guidelines for major NP syndromes (e.g., post-herpetic neuralgia, diabetic peripheral neuropathy, chemotherapy-induced neuropathy, trigeminal neuralgia), and examines medication availability and the pharmacist's role in NP management.

The qualification work consists of an Introduction, 3 chapters, conclusions, a list of used sources and is laid out on 42 pages of printed text. The work is illustrated with 7 figures and 8 tables. The bibliography includes 39 information sources.

Key words: neuropathic pain, elderly patients, pharmaceutical care, post-herpetic neuralgia, pharmacist's role, shingles.

АНОТАЦІЯ

У магістерській роботі досліджено сучасні підходи до фармацевтичної опіки при лікуванні невропатичного болю (НБ) у пацієнтів літнього віку. Проаналізовано міжнародну літературу щодо поширеності, патофізіології та класифікації НБ у літніх людей; здійснено огляд клінічних настанов щодо терапії синдромів НБ (зокрема постгерпетичної невралгії та діабетичної периферичної нейропатії тощо); досліджено доступність лікарських засобів та роль фармацевта у веденні НБ.

Кваліфікаційна робота складається зі вступу, 3 розділів, висновків, списку використаних джерел і розміщена на 42 сторінках друкованого тексту. Робота ілюстрована 7 рисунками та 8 таблицями. Бібліографія містить 39 джерел інформації.

Ключові слова: нейропатичний біль, пацієнти похилого віку, фармацевтична допомога, постгерпетична невралгія, роль фармацевта, оперізувальний герпес.

CONTENTS

LIST OF ABBREVIATIONS

ACE – angiotensin-converting enzyme

AAN – American Academy of Neurology

AED – anti-epileptic drug

CDC – Centres for Disease Control and Prevention

CI – confidence interval

CPSP – central post-stroke pain

DFU – diabetic foot ulcer

DPN – diabetic peripheral neuropathy

EFNS – European Federation of Neurological Societies

FDA – U.S. Food and Drug Administration

GABA – gamma-aminobutyric acid

IASP – International Association for the Study of Pain

NICE – National Institute for Health and Care Excellence (UK)

NP – neuropathic pain

PHN – post-herpetic neuralgia

QoL – quality of life

RR – relative risk

SSRI – selective serotonin reuptake inhibitor

SNRI – serotonin-noradrenaline reuptake inhibitor

TCA – tricyclic antidepressant

INTRODUCTION

Neuropathic pain (NP) is pain arising as a direct consequence of a lesion or disease affecting the somatosensory system. Unlike nociceptive pain, which results from tissue damage or inflammation, NP results from neuroplastic alterations in the peripheral or central nervous system. As populations age worldwide, the prevalence of NP in elderly individuals has increased markedly. Epidemiological studies estimate that 7–10 % of the general adult population suffer from neuropathic pain, whereas in older adults the prevalence ranges from 11 % to 35 % [5, 16, 37]. Ageing is accompanied by comorbidities, polypharmacy, cognitive impairment and decreased physiological reserves, all of which complicate the management of NP in elderly patients. In addition, conditions such as diabetic peripheral neuropathy, post-herpetic neuralgia after shingles, trigeminal neuralgia, and chemotherapy-induced neuropathy become more frequent with increasing age.

Pharmaceutical care encompasses the responsible provision of pharmacotherapy to achieve definite outcomes that improve a patient's quality of life. When applied to neuropathic pain, pharmaceutical care involves selecting appropriate medications, ensuring adherence, monitoring therapeutic and adverse effects, preventing drug interactions and educating patients. Evidence-based guidelines highlight the use of tricyclic antidepressants (e.g., amitriptyline), serotonin–noradrenaline reuptake inhibitors (e.g., duloxetine), gabapentinoids (gabapentin and pregabalin) and topical agents as first-line pharmacotherapy for neuropathic pain [3, 10, 13, 34]. Elderly patients, however, are particularly susceptible to medication-related harms such as falls, hyponatraemia and cognitive decline, necessitating tailored pharmacotherapeutic approaches [3, 10, 13, 34]. The role of the pharmacist extends beyond medication supply to encompass medication review, deprescribing, patient counselling, and participation in multidisciplinary pain teams.

Purpose of the study. The objective of this research is to analyse current approaches to pharmaceutical care in the management of neuropathic pain in elderly patients.

Tasks of the study. In accordance with the purpose, the following tasks were defined:

1. Conduct a literature review on the definition, classification and pathophysiology of neuropathic pain in the context of ageing.
2. Investigate the global and national prevalence of NP and its impact on quality of life.
3. Analyze current international guidelines on the treatment of NP, focusing on first-line, second-line and combination therapies and their safety profiles in older adults.
4. Review non-pharmacological and adjuvant therapies applicable to elderly patients.
5. Evaluate the availability of medicines, costs of treatment and health system considerations affecting access to pharmacotherapy for NP.
6. Examine the role of pharmacists in the management of NP, including medication review, patient education and participation in multidisciplinary care.

Object of research. The object of the study is the body of scientific literature, clinical guidelines, health policy documents and statistical data on neuropathic pain in elderly patients.

Subject of research. The subject is the organisation of pharmaceutical care services and interventions aimed at optimising the management of NP in older adults.

Research methods. Methods used include systematic literature analysis, comparative and logical analysis of guidelines, graphic representation of data, descriptive statistics and synthesis of evidence from systematic reviews. Pharmacoeconomic comparisons were drawn using cost-effectiveness data where available.

Scientific novelty and practical significance. This work offers a comprehensive synthesis of contemporary international data on NP in the elderly, integrates pharmacological and non-pharmacological management strategies, evaluates access to medicines, and articulates a pharmacist-centric framework for patient care. The outcomes can inform curriculum development for pharmacy students

and continuing education for practising pharmacists, as well as contribute to guideline development and health policy.

Structure and scope. The qualification work comprises three chapters, conclusions, a reference list and appendices. It spans 42 pages of text, includes 8 tables and 7 figures. The list of references comprises more than 39 sources.

Chapter 1.
LITERATURE REVIEW ON NEUROPATHIC PAIN IN THE ELDERLY

1.1 Definition and classification of neuropathic pain

Neuropathic pain (NP) is defined by the International Association for the Study of Pain as "pain arising as a direct consequence of a lesion or disease affecting the somatosensory system." This definition emphasises a pathophysiological basis distinct from nociceptive or inflammatory pain. NP may originate in the peripheral nervous system (peripheral NP) or the central nervous system (central NP). Mixed pain states encompass both neuropathic and nociceptive components, as seen in cancer pain or low back pain. The classification of neuropathic pain used in this thesis is summarised in Fig. 1.1.

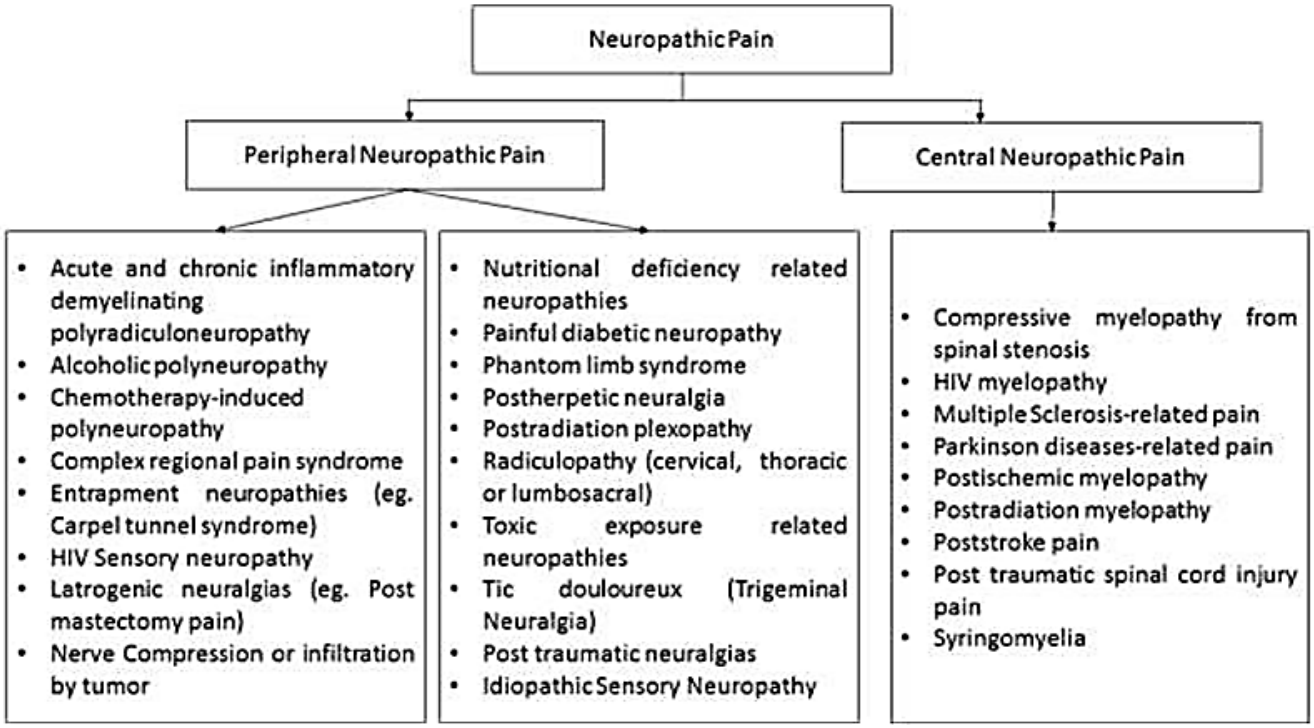

Fig. 1.1. Classification of neuropathic pain by site of lesion and typical conditions [16, 17]

Key differences between neuropathic pain and nociceptive pain are presented in Table 1.1.

Table 1.1

Key differences between neuropathic pain and nociceptive pain

Feature	Neuropathic pain	Nociceptive pain
Pathophysiology	Lesion or disease of the somatosensory system; spontaneous neuronal firing, central and peripheral sensitisation	Activation of nociceptors by tissue injury or inflammation; proportional to stimulus intensity
Quality of pain	Burning, shooting, electric shock-like, tingling, numbness, allodynia	Aching, throbbing, sharp or dull, often well localised
Common causes	PHN, DPN, trigeminal neuralgia, CIPN, central post-stroke pain	Osteoarthritis, musculoskeletal injury, postoperative pain
Response to analgesics	Poor response to non-steroidal anti-inflammatory drugs (NSAIDs) and weak opioids; responds better to antidepressants, gabapentinoids, topical agents	Good response to NSAIDs, paracetamol, opioids
Impact on QoL	Greater interference with sleep, mood and daily functioning	Usually resolves as tissue heals; less persistent interference

Neuropathic pain is then subdivided into peripheral and central neuropathic pain to align with peripheral and central somatosensory nervous system damage. Subsets of neuropathic pain may have distinct pathophysiologic causes and present with different clinical signs and symptoms. Despite the shared mechanism of nociception across neuropathic pain conditions, the diversity of underlying cause may explain the mixed response to a unified treatment paradigm (Fig. 1.2) [17].

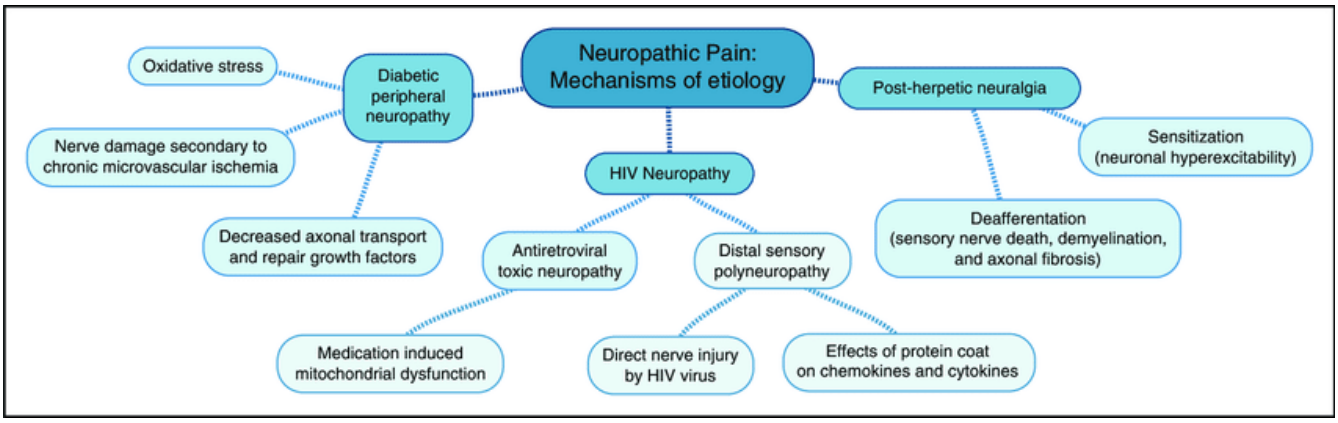

Fig. 1.2 Causes of neuropathic pain [17].

Peripheral neuropathic pain. This category includes conditions such as post-herpetic neuralgia (PHN), diabetic peripheral neuropathy (DPN), trigeminal neuralgia, radiculopathies, carpal tunnel syndrome and chemotherapy-induced peripheral neuropathy. Peripheral NP results from damage to peripheral nerves, ganglia or plexuses. Clinically, patients may experience burning or shooting pain, allodynia (pain from non-noxious stimuli), hyperalgesia (increased pain from normally painful stimuli) and sensory deficits. Diabetic peripheral neuropathy is one of the most common forms of NP; up to 50 % of diabetic patients may develop neuropathic pain [5, 16, 37].

Central neuropathic pain. Central NP arises from lesions or dysfunction within the central nervous system. Examples include central post-stroke pain, pain associated with multiple sclerosis, spinal cord injury and Parkinson's disease. Patients often describe spontaneous electric shock-like pain, along with abnormal sensations such as dysaesthesia or phantom limb pain in amputees.

Post-herpetic neuralgia (PHN). A subset of peripheral neuropathic pain, PHN is a chronic pain syndrome following reactivation of latent varicella-zoster virus (VZV). Shingles (herpes zoster) affects one in three individuals during their lifetime; about 20 % of those with shingles develop PHN, and the risk increases with age [5, 16, 37]. Elderly patients with PHN report severe burning or stabbing pain along dermatomal distributions, sometimes persisting months to years after rash resolution.

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Diabetic peripheral neuropathy (DPN). DPN results from chronic hyperglycaemia leading to metabolic and microvascular changes. Neuropathy may be sensorimotor, autonomic or focal. Small-fibre neuropathy manifests as burning pain in distal extremities, often described as "stocking and glove" distribution. Ageing, poor glycaemic control and long diabetes duration are strong risk factors for DPN [5, 16, 37].

Chemotherapy-induced peripheral neuropathy (CIPN). Neurotoxic chemotherapeutic agents such as platinum compounds, taxanes and vinca alkaloids can cause sensory neuropathy characterised by distal paresthesias and pain. Symptoms often peak after treatment cessation but may persist for months or years. Incidence varies by agent and dose; up to 68 % of patients experience CIPN one month after therapy.

Trigeminal neuralgia. This craniofacial pain syndrome involves brief episodes of severe, unilateral facial pain triggered by speaking, chewing or touching the face. It is often caused by vascular compression of the trigeminal nerve root or demyelinating lesions. Prevalence increases with age; median age at diagnosis is 60 years.

1.2 Pathophysiology and risk factors in ageing populations

The pathogenesis of neuropathic pain involves complex mechanisms at the molecular, cellular and system levels. Injury or disease leads to abnormal excitability and ectopic activity in primary afferent neurons, altered synaptic transmission in the dorsal horn, and maladaptive neuroplasticity in supraspinal structures. Key pathophysiological features include the following:

- Peripheral sensitisation and ectopic firing. Injury to nerves up-regulates sodium channels, increases expression of nociceptor receptors (e.g., TRPV1) and reduces inhibitory ion channel activity. These changes result in spontaneous discharges and lowered thresholds for activation.
- Central sensitisation. Persistent nociceptive input can cause increased excitability of dorsal horn neurons, enhanced synaptic efficacy (wind-up) and reduced GABAergic inhibition. Microglial activation and the release of pro-inflammatory cytokines (e.g., TNF-α, IL-1β) further amplify neuronal excitability.
- Dysfunction of descending pain modulation. Noradrenergic and serotonergic pathways originating in the brainstem modulate spinal nociceptive processing. In neuropathic pain, reduced inhibitory descending control contributes to persistent pain.
- Neuroimmune interactions. Activation of immune cells (microglia, macrophages, T-lymphocytes) leads to the release of cytokines and chemokines that promote neuronal hyperexcitability and maintain chronic pain states.

Ageing affects the nervous system in ways that predispose individuals to neuropathic pain. There is a reduction in the number of sensory neurons, decreased axonal diameter and conduction velocity, and diminished regenerative capacity. Oxidative stress and mitochondrial dysfunction accumulate with age, leading to neuronal damage [17]. Age-related microvascular disease contributes to hypoxia of

nerve tissues, particularly in diabetic patients. Elderly individuals also have impaired immune responses, increasing susceptibility to herpes zoster reactivation and persistent inflammation.

Risk factors for neuropathic pain in the elderly include: advanced age, female sex, diabetes mellitus, herpes zoster infection, HIV infection, chemotherapy, vitamin B deficiency, chronic alcohol misuse, trauma or surgery, and genetic predisposition. Socioeconomic factors such as poverty and limited access to healthcare can contribute to delayed diagnosis and inadequate treatment.

1.3 Burden of neuropathic pain and quality of life

Neuropathic pain imposes substantial burden on patients, caregivers and health systems. Patients with NP often report severe, persistent pain that interferes with sleep, mobility and daily activities. Compared with nociceptive pain, NP has higher odds of associated anxiety, depression and cognitive impairment. A survey of older adults with neuropathic pain showed that 60 % experienced sleep disturbances, 50 % had reduced mobility and 40 % developed depressive symptoms. About 30 % required assistance with activities of daily living.

The economic burden is considerable. Direct costs include medical consultations, diagnostic tests, medications and hospitalisations. Indirect costs result from absenteeism, decreased productivity, caregiver time and early retirement. A UK study estimated that patients with neuropathic pain incurred annual healthcare costs £560 higher than those with nociceptive pain. Cost-of-illness analyses reveal that pharmacological treatment constitutes a significant portion of expenses, particularly in countries without adequate insurance coverage or reimbursement policies.

Elderly patients are particularly vulnerable because NP often coexists with comorbidities such as cardiovascular disease, renal insufficiency and cognitive impairment, leading to polypharmacy and increased risk of drug interactions. Pain also exacerbates frailty, increases fall risk and impairs social participation. Because older adults might underreport pain due to stoicism or fear of being burdensome, NP is frequently underdiagnosed and undertreated.

The burden of herpes zoster disease is significant worldwide, with millions affected and an increasing incidence. Increased age and immunosuppression due to disease or drugs have been related to its recurrence [23].

The economic and social burden of shingles is profound and multifaceted, impacting individuals, families, and entire communities across the globe. Around 30% of the population will experience herpes zoster (HZ), 10% of whom develop PHN. Together, these illnesses produce a significant economic burden to the healthcare system [9].

Patients with PHN generally utilize more healthcare resources than HZ patients without neurological complications. This results in elevated costs and expenditures, which often escalate with age, but other researchers have not substantiated this conclusion. Yawn et al. estimated that hospital care constituted 13.5%, 39.4%, and 50.9% of the average global cost per HZ case, PHN case, and complex non-PHN HZ case, respectively.

Research indicates that, although expensive, the treatment of hospitalized patients is not the primary cost driver for an average HZ case; rather, general practitioner management and pharmacotherapy incur greater expenses. Insinga et al. determined that hospital care constituted 18% of total spending, but Yawn et al. indicated a figure of 29.3%. Mick et al. reported comparable figures, estimating that hospital care constituted 18% of the global cost of shingles and 23% of the global cost of PHN from the perspective of third-party payers.

Indirect expenses include diminished productivity and work absenteeism. These expenses might be directly attributed to the patients or their caregivers [7]

Summarizing economical and social burden of shingles in Europe is demonstrated in fig. 1.3.

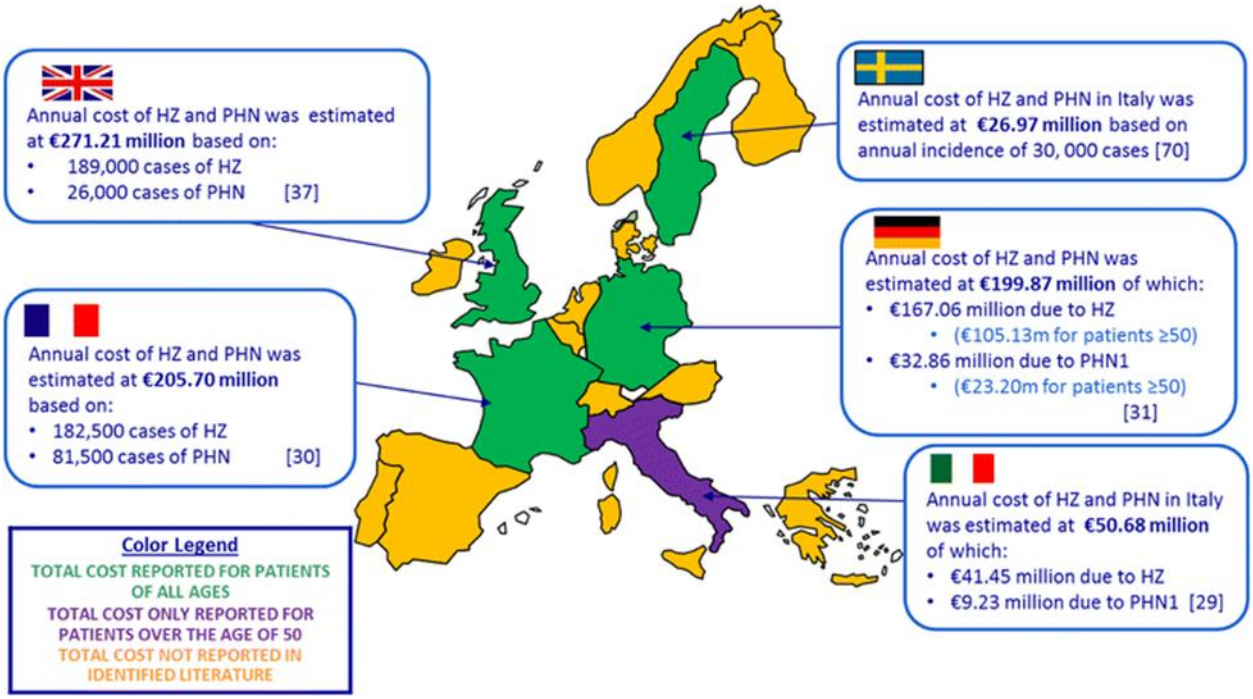

Fig 1.3 The economic and social burden of HZ in Europe

Conclusions for Chapter 1.

1. Neuropathic pain is a complex. The literature review clarified that neuropathic pain is a heterogenous syndrome arising from lesions or diseases of the somatosensory system. It encompasses peripheral and central forms, each with distinct clinical features and underlying mechanisms.

2. Age-related neurodegenerative changes and the increased prevalence of conditions such as diabetes, shingles and cancer make NP common among older adults. The resulting pain significantly impairs quality of life and imposes a substantial socioeconomic burden.

3. Key mechanisms underlying NP include peripheral and central sensitisation, neuroimmune interactions and impaired descending inhibition. Understanding these processes is essential for developing effective pharmaceutical care strategies tailored to the needs of elderly patients.

Chapter 2.
STUDY ON PREVALENCE AND CURRENT TREATMENT APPROACHES OF NEUROPATHIC PAIN IN ELDERLY

2.1 Global and national prevalence of neuropathic pain overview

Estimates of the prevalence of neuropathic pain vary owing to different definitions, populations and survey methodologies. In population-based studies conducted in Europe and North America, the point prevalence of chronic pain with neuropathic characteristics ranges from 3 % to 8 %, while lifetime prevalence is up to 10 %. When focusing on older adults, cross-sectional studies indicate that between 11 % and 35 % of individuals aged ≥65 years experience NP symptoms [5, 16, 37]. Higher prevalence in older populations is attributed to accumulated neural injuries, comorbidities and decreased physiological reserve (Fig 2.1.).

The prevalence of neuropathic pain conditions in selected elderly populations is summarised in Table 2.1.

At the national level, data on neuropathic pain in Ukraine are limited, but extrapolation from European cohorts suggests that approximately 15 % of Ukrainian adults over 60 years may suffer from neuropathic pain. Ageing of the population and the rise in diabetes prevalence in Ukraine support this estimate. In the absence of comprehensive national epidemiological surveys, local studies among primary care patients are needed.

Table 2.1

Prevalence of neuropathic pain conditions in selected elderly populations

Condition	Estimated prevalence among elderly	Notes
Post-herpetic neuralgia (PHN)	1–5 % of older adults; ~20 % of patients with shingles develop PHN	Risk increases sharply with age; PHN more common in women
Diabetic peripheral neuropathy (DPN)	Up to 26 % of persons with diabetes develop painful DPN; about 50 % of elderly diabetics have some neuropathy	Risk correlates with duration of diabetes, glycaemic control and presence of diabetic foot ulcers
Chemotherapy-induced neuropathy	30–68 % of patients receiving neurotoxic chemotherapy (e.g., platinum agents, taxanes); prevalence increases with cumulative dose	High incidence in older cancer patients owing to age-related pharmacokinetic changes
Trigeminal neuralgia	Lifetime prevalence ~0.3 % in elderly; incidence 4–8 per 100 000 person-years	Often misdiagnosed; may be secondary to vascular compression or demyelinating diseases
Central post-stroke pain	Occurs in 8 % of stroke survivors; risk increases with thalamic or brainstem lesions	Onset may be delayed months or years after stroke

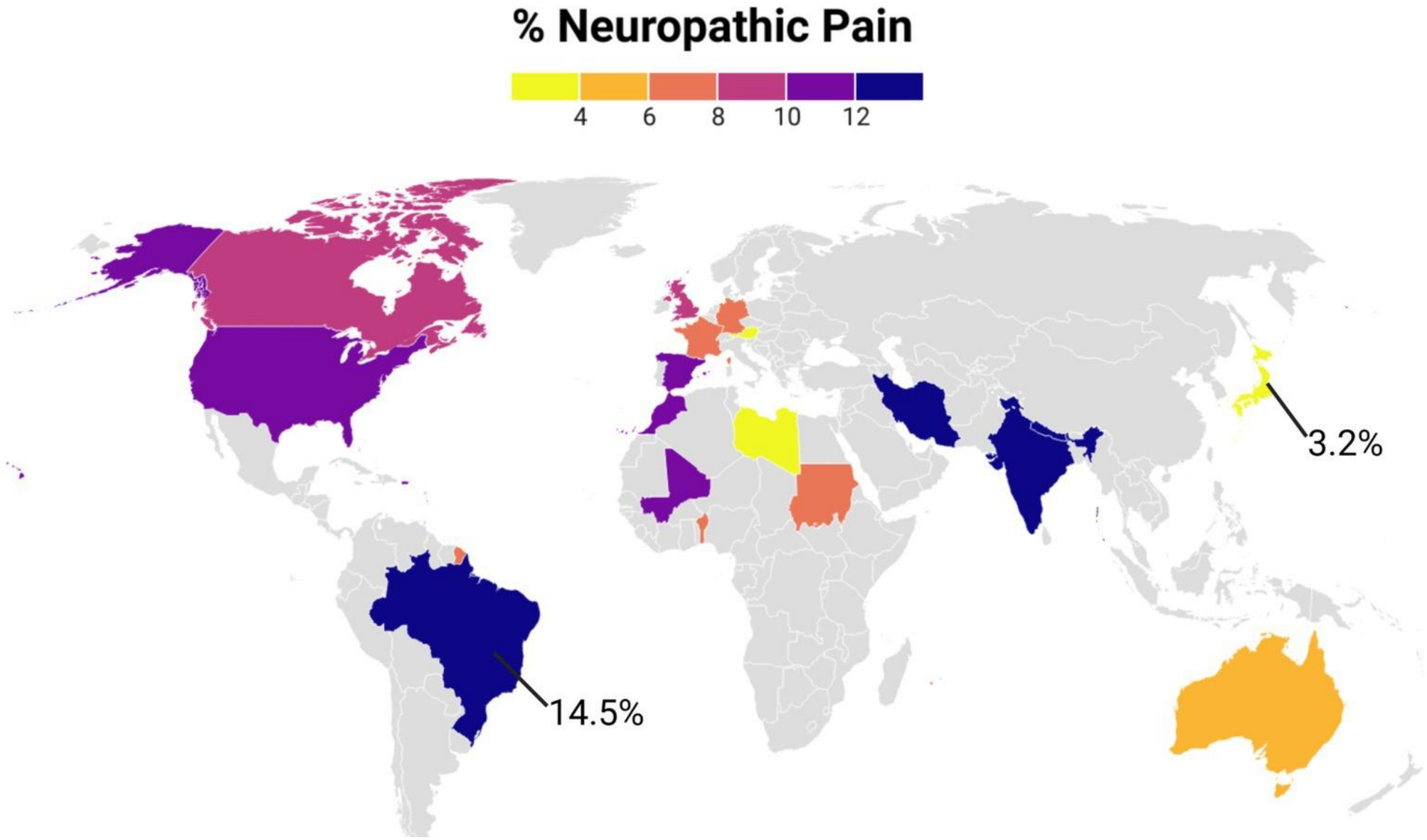

Fig. 2.1. Prevalence of neuropathic pain in general population, elderly adults and diabetic neuropathy

2.2 Explore of evidence-based guidelines for the treatment of neuropathic pain

Several professional organisations have developed guidelines for the management of neuropathic pain. Notable among these are the International Association for the Study of Pain (IASP), the European Federation of Neurological Societies (EFNS), the National Institute for Health and Care Excellence (NICE), the American Academy of Neurology (AAN), and the Derbyshire Joint Area Prescribing Committee (JAPC) in the UK. Although differences exist in wording and drug availability, there is general consensus on first-line pharmacotherapy: tricyclic antidepressants (TCAs) such as amitriptyline, serotonin–noradrenaline reuptake inhibitors (SNRIs) such as duloxetine and venlafaxine, and gabapentinoids such as gabapentin and pregabalin [3, 10, 13, 34].

Table 2.2 provides an overview of guideline recommendations for first- and second-line pharmacotherapy in neuropathic pain.

The guidelines agree that antidepressants and gabapentinoids should be tried before opioids. TCAs have robust evidence of efficacy (number needed to treat [NNT] around 3) and are highly cost-effective [3, 10, 13, 34]. SNRIs such as duloxetine have moderate efficacy (NNT ~6–7) and offer additional benefits for concomitant depression. Gabapentinoids have NNTs of 3–5 but carry risks of sedation, dizziness and falls, particularly in elderly patients. The JAPC guideline emphasises that amitriptyline is the most cost-effective first-line option and that duloxetine is a reasonable second-line; pregabalin, gabapentin and tramadol should be used cautiously and only when necessary [3, 10, 13, 34].

Table 2.2

Overview of guideline recommendations for first- and second-line pharmacotherapy in neuropathic pain

Guideline (year)	First-line therapy	Second-line therapy	Notes
IASP (2020)	TCAs (amitriptyline), SNRIs (duloxetine, venlafaxine), gabapentinoids (gabapentin, pregabalin)	Tramadol, strong opioids, topical lidocaine or capsaicin for localised NP	Emphasises individualised treatment; consider comorbidities and drug interactions
EFNS (2015)	TCAs, SNRIs, gabapentinoids	Tramadol, opioids, topical lidocaine, capsaicin	Recommends carbamazepine for trigeminal neuralgia
NICE (2021)	Amitriptyline, duloxetine, pregabalin or gabapentin as first-line; switch or combine if inadequate	Tramadol for acute rescue; topical capsaicin for localised pain	Warns against long-term use of opioids; emphasises analgesic review after 8 weeks
AAN (2011)	TCAs, SNRIs, gabapentin, pregabalin	Weak opioids, mexiletine, topical lidocaine	Evidence rated according to strength; emphasises patient preferences
JAPC (2023)	Amitriptyline as cost-effective first-line; duloxetine second-line; gabapentinoids considered with caution	Tramadol limited to acute rescue; combination therapy may be more effective than switching [3, 10, 13, 34]	Highlights cost-effectiveness of TCAs; warns about misuse of pregabalin and gabapentin [3, 10, 13, 34]

Topical agents such as lidocaine 5 % patches and capsaicin 8 % patches are recommended for localised neuropathic pain and have minimal systemic side effects. Strong opioids (e.g., oxycodone, morphine) are considered third-line or rescue therapy due to limited evidence of efficacy and high risk of adverse effects and dependence, especially in older adults.

Treatment considerations in the elderly. Older adults metabolise drugs differently due to reduced hepatic and renal function, decreased plasma protein binding and altered body composition. Polypharmacy increases the risk of drug interactions. Adverse effects such as orthostatic hypotension, anticholinergic symptoms and cardiac arrhythmias are of particular concern with TCAs in the elderly. Duloxetine and venlafaxine may cause hypertension, nausea and sleep disturbances. Gabapentinoids cause sedation, dizziness, gait instability and cognitive impairment, increasing fall risk. Prescribers should start at low doses, titrate slowly, monitor renal function and regularly review the need for continuation [3, 10, 13, 34]. Hyponatraemia is a known adverse effect of both antidepressants and carbamazepine; monitoring of electrolytes is recommended [3, 10, 13, 34].

In addition to the general guidelines, specific recommendations exist for particular conditions:

- Post-herpetic neuralgia. Guidelines recommend TCAs, gabapentin or pregabalin, and topical lidocaine or capsaicin. Early antiviral therapy in shingles reduces the risk of PHN, but once established, PHN often requires combination therapy. Strong opioids are reserved for refractory cases.
- Diabetic peripheral neuropathy. SNRIs (especially duloxetine) and gabapentinoids are approved by the FDA for DPN. Tight glycaemic control, lifestyle interventions and foot care are essential. Opioids are generally discouraged. Alpha-lipoic acid and benfotiamine have modest evidence of symptom relief.
- Trigeminal neuralgia. Carbamazepine is the drug of first choice; oxcarbazepine is an alternative with fewer drug interactions. Baclofen may provide additional benefit. Surgical options are considered for refractory cases.
- CIPN. Currently there are no FDA-approved drugs for CIPN; duloxetine has shown modest benefit. Preventive strategies such as dose reduction and limiting

cumulative exposure to neurotoxic agents are important. Topical capsaicin and lidocaine patches may be tried.

2.3 Analysis of pharmacological therapy approaches of neuropathic pain

Effective management of neuropathic pain in elderly patients often requires individualised combination therapy. Figure 2.2 summarises a stepwise algorithm for pharmacological management.

Tricyclic antidepressants (TCAs). Amitriptyline is the most studied TCA for NP. Starting doses are 10–25 mg at bedtime; doses are titrated to 75–100 mg/day. Nortriptyline and desipramine have fewer anticholinergic effects and are sometimes preferred. Adverse effects include dry mouth, constipation, urinary retention, blurred vision, sedation, orthostatic hypotension and cardiac arrhythmias. TCAs should be avoided in patients with uncontrolled cardiovascular disease or glaucoma. They are contraindicated with monoamine oxidase inhibitors (MAOIs). In the elderly, starting doses should be low and ECG monitoring may be necessary.

Serotonin-noradrenaline reuptake inhibitors (SNRIs). Duloxetine is approved for DPN and chronic musculoskeletal pain. Initial dosing is 30 mg/day, increasing to 60 mg/day. Venlafaxine (37.5 mg twice daily) is another option but has less evidence. SNRIs are useful in patients with concomitant depression or anxiety. Common adverse effects include nausea, dry mouth, constipation, insomnia and elevated blood pressure. Liver function monitoring is recommended for duloxetine.

Gabapentinoids. Gabapentin and pregabalin modulate calcium channels and reduce excitatory neurotransmitter release. Gabapentin is started at 100–300 mg at bedtime, titrated to 1 800–3 600 mg/day in divided doses. Pregabalin is started at 25–75 mg/day and titrated to 300–600 mg/day. Dose adjustments are required in renal impairment. Adverse effects include dizziness, somnolence, ataxia, peripheral oedema and weight gain. Misuse and diversion of gabapentinoids have been reported; caution is warranted [3, 10, 13, 34].

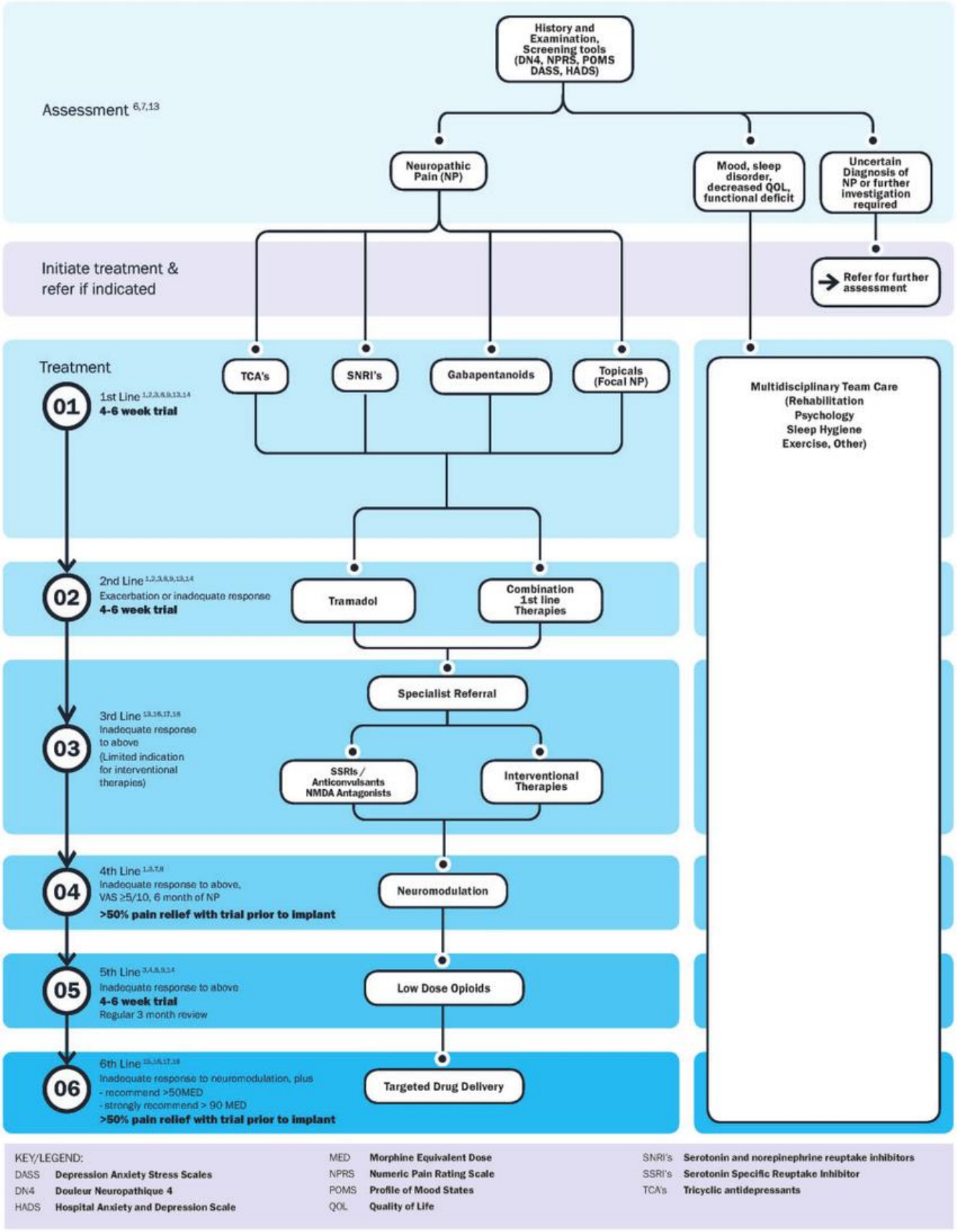

Fig. 2.2. Stepwise algorithm for the pharmacological management of neuropathic pain

Topical agents. Lidocaine 5 % patches provide local analgesia with minimal systemic effects. The patch is applied to the painful area for up to 12 hours in a 24-hour period. Capsaicin 8 % patches deliver high-concentration capsaicin to deplete substance P; patches are applied under medical supervision every 3 months. Topical agents are particularly suitable for localised peripheral NP and for patients unable to tolerate systemic drugs.

Tramadol. A weak opioid agonist and serotonin-noradrenaline reuptake inhibitor, tramadol is indicated for moderate to severe NP when first-line therapy is inadequate. It is prescribed at 50–100 mg every 4–6 hours (maximum 400 mg/day). Adverse effects include nausea, constipation, dizziness, sedation and risk of serotonin syndrome when combined with antidepressants. The JAPC guideline cautions that tramadol should be reserved for acute rescue therapy and used for the shortest possible duration [3, 10, 13, 34].

Strong opioids. Morphine, oxycodone and methadone may provide relief for refractory NP. However, evidence of efficacy is limited and adverse effects, constipation, nausea, sedation, cognitive impairment, falls, respiratory depression and dependence, are significant. Opioids should be considered only when other treatments have failed and under specialist supervision. Careful titration and monitoring are essential.

Other antiepileptic drugs. Carbamazepine is first-line for trigeminal neuralgia and may be useful in other neuropathic conditions. It induces hepatic enzymes and interacts with many drugs. Adverse effects include dizziness, ataxia, hyponatraemia, aplastic anaemia and Stevens–Johnson syndrome; HLA-B*1502 screening is recommended in certain ethnicities. Other antiepileptics such as lamotrigine, topiramate and valproate have inconsistent evidence and are not routinely recommended.

NMDA receptor antagonists. Ketamine and dextromethorphan have been studied for NP. Ketamine infusions may benefit patients with refractory NP but are limited by psychotomimetic side effects and need for monitoring. Dextromethorphan has modest efficacy; its use is limited by dizziness and gastrointestinal upset.

Combination therapy. Combining drugs with complementary mechanisms can enhance analgesia while allowing lower doses of each agent, thereby reducing side effects. Examples include TCA plus gabapentin, SNRI plus gabapentin, or gabapentin plus tramadol. Combination therapy should be considered after inadequate response to monotherapy and should be monitored for additive adverse effects.

Table 2.3 summarises pharmacological options for neuropathic pain and considerations in elderly patients.

Also, non-pharmacological interventions play a vital role in comprehensive care for neuropathic pain, particularly when pharmacological therapy alone is insufficient or contraindicated. Evidence-based non-pharmacological modalities include:

- Physical therapy and exercise. Tailored exercise programs improve mobility, strength and balance. Aerobic exercise may reduce neuropathic symptoms through endogenous opioid release and improved microcirculation. For diabetic peripheral neuropathy, weight-bearing exercises should be cautiously introduced to prevent foot injuries. Balance training can reduce fall risk in elderly patients.
- Transcutaneous electrical nerve stimulation (TENS). TENS provides pain relief through activation of non-nociceptive fibres that inhibit transmission of pain signals (gate control theory). Small trials suggest benefit in PHN and DPN, although evidence quality is low.
- Cognitive-behavioural therapy (CBT). CBT helps patients reframe negative thoughts about pain, develop coping strategies and improve self-efficacy. Integration of CBT into chronic pain management reduces anxiety and depression and enhances quality of life.
- Mind–body therapies. Techniques such as mindfulness meditation, yoga and tai chi may reduce pain perception and improve well-being. These practices also enhance balance, flexibility and mood in older adults.
- Interventional procedures. In refractory cases, nerve blocks, epidural steroid injections, spinal cord stimulation and dorsal root ganglion stimulation may be considered. For trigeminal neuralgia, percutaneous rhizotomy, gamma knife radiosurgery or microvascular decompression are options when pharmacotherapy fails.

Table 2.3.

Pharmacological options for neuropathic pain and considerations in elderly patients

Drug/Class	Typical dose range	Key adverse effects	Considerations in elderly
Amitriptyline (TCA)	10–100 mg/day	Anticholinergic effects, orthostatic hypotension, arrhythmias	Start at 10 mg; avoid in cardiac disease or cognitive impairment; monitor ECG and electrolytes
Duloxetine (SNRI)	30–60 mg/day	Nausea, dry mouth, hypertension, hepatotoxicity	Check liver function; avoid if severe hepatic or renal impairment; monitor blood pressure
Gabapentin	300–3 600 mg/day	Sedation, dizziness, ataxia, peripheral oedema	Adjust dose for renal function; titrate slowly; caution with fall risk
Pregabalin	75–600 mg/day	Somnolence, dizziness, weight gain, peripheral oedema	Renal dose adjustment; monitor for misuse; caution in heart failure
Lidocaine 5 % patch	Up to 3 patches on skin for 12 h/day	Local erythema, pruritus	Safe in most elderly; avoid on broken skin
Capsaicin 8 % patch	Applied in clinic every 3 months	Burning sensation during application	Use with caution in sensory loss; application may be painful
Tramadol	50–400 mg/day	Nausea, constipation, dizziness, serotonin syndrome	Risk of falls and dependence; avoid with SSRIs/SNRIs if possible; adjust for renal/hepatic impairment
Morphine/Oxycodone	Titrated individually	Sedation, constipation, nausea, respiratory depression	Last resort; monitor closely; consider laxative prophylaxis
Carbamazepine	200–1 200 mg/day	Dizziness, ataxia, hyponatraemia, drug interactions	HLA-B*1502 screening; monitor sodium and blood counts
Ketamine	Intravenous or oral titration	Psychotomimetic effects, hypertension	Specialist use only; monitor vital signs

- Vitamin and nutritional supplementation. Alpha-lipoic acid, vitamin B complex, magnesium and omega-3 fatty acids have been studied for DPN, with mixed results. Maintaining adequate nutrition supports neuronal health.
- Vaccination and prevention. Prevention of PHN involves vaccination against herpes zoster using recombinant zoster vaccine (RZV). RZV is recommended for adults aged ≥50 years and has >90 % efficacy against shingles. Pharmacists can deliver vaccines and educate patients about the benefits.

Conclusions for Chapter 2.

1. Neuropathic pain is prevalent among. Neuropathic pain is highly > prevalent among elderly populations and encompasses a spectrum of > conditions including post-herpetic neuralgia, diabetic peripheral > neuropathy, chemotherapy-induced peripheral neuropathy and > trigeminal neuralgia.
2. International guidelines converge on tricyclic antidepressants, > serotonin-noradrenaline reuptake inhibitors, gabapentinoids and > topical agents as first-line therapies for NP. In older adults, > careful dose titration, regular monitoring and avoidance of > polypharmacy are critical due to altered pharmacokinetics and > heightened vulnerability to adverse effects.
3. Exercise, cognitive-behavioural therapy, transcutaneous electrical > nerve stimulation, nutritional supplementation and vaccination > against herpes zoster complement pharmacological management and > should be incorporated into patient-centred care plans.

Chapter 3.
EVALUATION OF PHARMACEUTICAL CARE AND THE PHARMACIST'S ROLE IN POST-HERPETIC NEURALGIA

3.1 Evaluation of availability and accessibility of medicines used in post-herpetic neuralgia treatment

Post-herpetic neuralgia (PHN) is a chronic pain condition that arises after an episode of shingles. Effective pharmaceutical care for PHN requires timely access to antiviral therapy during the acute phase of herpes zoster and ongoing access to analgesics, adjuvant medications and vaccines.

For primary care providers, PHN may not present as a distinctentity but rather an extension of the original HZ infection, andmonitoring for a global condition affecting multiple aspects ofpatients'lives rather than for a localized post-HZ pain is para-mount. Thus, practical management of PHN can be dividedinto prevention and treatment of HZ, and the more challeng-ing task of managing the neuropathic pain syndrome and itsconsequences once PHN has developed (Fig. 3.1) [6].

The key determinants of access are highlighted below.

1. Availability of antivirals and analgesics. Antiviral medications (acyclovir, valacyclovir and famciclovir) must be started within 72 hours of rash onset to reduce the risk of PHN. These generics are inexpensive and widely available but require rapid prescription and dispensing. For established PHN, amitriptyline, duloxetine, gabapentin, pregabalin, tramadol and opioids are the main analgesics. Some pharmacies may not stock high-concentration capsaicin patches or lidocaine plasters due to low demand and high cost.

2. Affordability and reimbursement. Many PHN patients are older adults living on fixed incomes. Generic tricyclic antidepressants and antivirals are affordable, whereas SNRIs, gabapentinoids and topical agents are more expensive. In Ukraine the "Available Medicines" programme does not cover PHN treatments; thus patients must pay out-of-pocket for duloxetine, pregabalin or capsaicin. High costs may lead to

underdosing or discontinuation. The recombinant zoster vaccine (RZV), which prevents shingles and PHN, is also expensive and not reimbursed.

3.

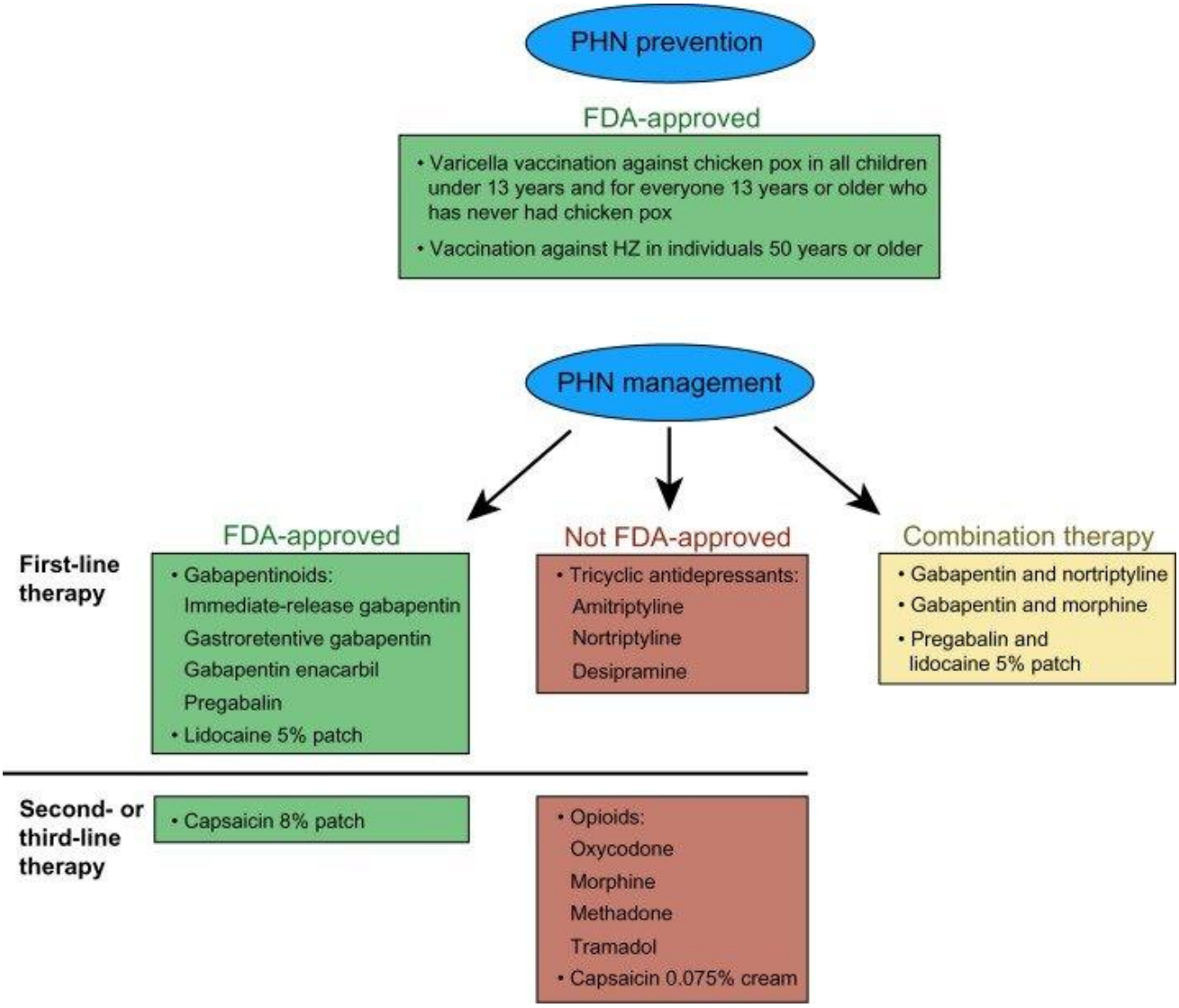

Fig. 3.1 Current postherpetic neuralgia (PHN) prevention and treatment options

4. Insurance coverage and policies. National insurance schemes may reimburse antivirals but restrict funding for newer or combination therapies. Pregabalin is often subject to prior authorisation due to concerns about misuse. Topical lidocaine and capsaicin may not be listed on formularies or may require specialist prescriptions. Vaccination against herpes zoster is not part of routine national immunisation schedules in Ukraine.

5. Vaccination costs. Immunisation with RZV reduces the incidence of shingles and PHN by over 90 %. However, the vaccine is relatively expensive and must

be purchased by patients. Limited supply and lack of public funding hinder uptake, particularly among retirees. Pharmacists can advocate for inclusion of RZV in national programmes.

6. Pharmacoeconomic considerations. Early antiviral therapy is highly cost-effective because it prevents PHN. For established PHN, cost-utility analyses show that tricyclic antidepressants offer the highest quality-adjusted life year (QALY) gain at the lowest cost, whereas gabapentinoids and duloxetine provide moderate benefit at higher cost [3, 10, 13, 34]. Healthcare payers should prioritise funding for interventions with favourable cost-effectiveness ratios.

7. Supply chain and formulary restrictions. Supply chain disruptions or pricing policies may cause temporary shortages of antivirals or gabapentinoids. Hospital and insurance formularies sometimes restrict access to gabapentin or pregabalin due to concerns about diversion. Community pharmacies may not stock RZV or high-concentration capsaicin patches, necessitating special orders.

After summarising these determinants, it is important to evaluate the direct costs of pharmacological therapies for acute herpes zoster and the comparative costs of available antiviral medicines. Tables 3.1 and 3.2 present cost calculations based on standard adult dosing and the ATC/DDD methodology (defined daily dose). Table 3.1 summarises approximate dosages, common adverse effects and retail prices of antivirals, corticosteroids and analgesics used in the acute management of shingles. Table 3.2 compares domestic and imported brands of valacyclovir, famciclovir and acyclovir in Ukraine, highlighting price differences between generic and brand-name products and calculating the cost per defined daily dose (DDD) and the total cost of a 7-day antiviral regimen.

Table 3.1

Estimated cost of pharmacologic therapies for acute herpes zoster

Medication	Adult dosage	Common adverse effects	Approximate cost*
Acyclovir (antiviral)	800 mg orally five times daily for 7 days	Diarrhoea, encephalopathy, headache, nausea, vomiting	US$20 for 45 generic 800 mg tablets
Famciclovir (antiviral)	500 mg orally three times daily for 7 days	Confusion, headache, nausea, Stevens–Johnson syndrome	US$32 for 21 generic 500 mg tablets; US$522 for brand
Valacyclovir (antiviral)	1 000 mg orally three times daily for 7 days	Dyspepsia, nausea, vomiting	US$24 for 21 generic 1 000 mg tablets; US$424 for brand
Prednisolone (corticosteroid)	Tapering course: 40 mg/day for 6 days, then 30 mg/day (days 7–10), 20 mg/day (days 11–14), 10 mg/day (days 15–18), 5 mg/day (days 19–21)	Dyspepsia, nausea, vomiting, hyperglycaemia	Variable cost depending on formulation
Prednisone (corticosteroid)	60 mg/day (days 1–7), 30 mg/day (days 8–14), 15 mg/day (days 15–21)	Dyspepsia, nausea, vomiting, insomnia	Variable cost depending on formulation
Acetaminophen (analgesic)	325–1 000 mg orally every 4–6 hours (max. 4 000 mg/day)	Headache, hepatotoxicity, hypertension, nausea	US$7 for 100 generic tablets
NSAIDs (e.g., ibuprofen)	400 mg orally every 4–6 hours (max. 2 400 mg/day)	Abdominal discomfort, dyspepsia, gastrointestinal bleeding, myocardial infarction	US$7 for 100 generic tablets

*Prices are approximate and based on retail costs reported in the original thesis for generic and brand formulations.

Table 3.2

Comparative cost of antiviral pharmacotherapy for herpes zoster (selected examples)

Active substance	Example product (strength, quantity)	Manufacturer & country	Average retail price (UAH)	DDD in package	Cost per DDD (UAH)	Cost of 7-day regimen (UAH)
Valacyclovir	Valavir® 500 mg tablets ×42	JSC “Pharmak”, Ukraine	774.48	7	110.64	774.48
	Valavir® 500 mg tablets ×10	JSC “Pharmak”, Ukraine	265.52	1.67	158.99	1 112.96
	Valacyclovir-Hetero 500 mg ×30	Hetero Labs, India	494.44	5	98.89	692.22
	Valacyclovir-Hetero 500 mg ×10	Hetero Labs, India	290.28	1.67	173.82	1 216.74
	Valtrex™ 500 mg ×10	Glaxo SmithKline, Spain	322.13	1.67	192.89	1 350.25
	Viraxa 250 mg ×21	Specifar SA, Greece	702.50	7	100.36	702.50
	Viraxa 500 mg ×14	Specifar SA, Greece	789.72	9.33	84.64	789.72
Famciclovir	Virostat® 250 mg ×21	JSC “Kyiv Vitamin”, Ukraine	561.24	7	80.18	561.24
Acyclovir	Aciclovir-Astrapharm 200 mg ×20	Astrapharm, Ukraine	51.78	1	51.78	362.46
	Aciclovir-Pharmak 200 mg ×20	JSC “Pharmak”, Ukraine	59.84	1	59.84	418.88
	Zovirax™ 200 mg ×25	Glaxo SmithKline, Spain	219.88	1.25	175.90	1 231.33

The analysis demonstrates that domestic generics of valacyclovir, famciclovir and acyclovir offer markedly lower costs per defined daily dose than imported generics or brand-name products. However, the total cost of a 7-day regimen still varies widely depending on strength and pack size. For example, a 7-day course of valacyclovir may cost between 774.48 and 1 237.16 UAH, whereas an equivalent course of imported brand Valtrex™ exceeds 1 300 UAH. Famciclovir products are generally more expensive than valacyclovir, while acyclovir generics are the cheapest option but require more frequent dosing (up to five tablets daily), potentially affecting adherence. These cost differences highlight the importance of pharmacist counselling to select affordable yet effective antivirals and to ensure patients understand dosing schedules.

3.2 Study of Shingles Prevention approach

Vaccination is the most effective strategy to prevent herpes zoster and its most debilitating complication, post-herpetic neuralgia (PHN). About one in three individuals will develop shingles during their lifetime, and 10–18 % of those cases will progress to PHN, with the risk increasing sharply with advancing age. Two vaccines have been licensed for the prevention of shingles: the live attenuated vaccine (Zostavax) and the recombinant zoster vaccine (RZV, marketed as Shingrix). Their key characteristics are summarised in Table 3.3.

The live attenuated vaccine was the first to be introduced and is administered as a single subcutaneous dose to adults aged ≥60 years. It reduces the incidence of shingles by approximately 50 % but its effectiveness wanes rapidly, falling to 41 % after 3 years in adults aged 70–79 years and to 18 % in those aged ≥80 years. In addition, protection diminishes to 15 % after 10 years. The recombinant vaccine is a non-live subunit vaccine containing glycoprotein E and an AS01_B adjuvant. It is given intramuscularly in two doses separated by 2–6 months and is recommended for adults aged ≥50 years, including those who are immunocompromised. Clinical trials have shown that RZV prevents more than 90 % of herpes zoster cases and maintains efficacy above 85 % even in individuals aged over 70 years.

Table 3.3

Comparative characteristics of zoster vaccines

Characteristic	Live attenuated vaccine (Zostavax)	Recombinant zoster vaccine (Shingrix)
Vaccine type	Live attenuated Oka/Merck strain	Recombinant subunit (glycoprotein E)
Dosing schedule	Single subcutaneous dose	Two intramuscular doses 2–6 months apart
Recommended age	Adults ≥60 years	Adults ≥50 years (including those ≥18 years at elevated risk)
Efficacy against shingles	~50 % overall efficacy; declines to 41 % (70–79 years) and 18 % (≥80 years) within 3 years	>90 % efficacy across all age groups
Duration of protection	Protection wanes substantially after 5 years; ~15 % efficacy at 10 years	Maintains >85 % efficacy for at least 7 years
Common adverse effects	Mild injection-site pain, headache, low-grade fever	Injection-site pain, myalgia, fatigue, fever
Contraindications	Immunosuppression, pregnancy	Severe allergic reaction to vaccine components
Availability in Ukraine	Not widely used; largely superseded by RZV but may still be available in private clinics	Available in private pharmacies; not reimbursed by national health insurance

Vaccination uptake among older adults remains suboptimal in many countries due to cost, limited awareness and vaccine availability. In Ukraine, RZV is not yet included in the national immunisation schedule, and patients must purchase the vaccine

privately. Pharmacists play a critical role in improving uptake by counselling patients, assessing eligibility, administering vaccines and advocating for inclusion of RZV in reimbursement programmes.

3.3 The evolving pharmacist's role in management of post-herpetic neuralgia

Pharmacists are accessible healthcare professionals who can substantially improve outcomes for patients suffering from post-herpetic neuralgia. Their roles span early intervention, preventive care, optimisation of pharmacotherapy and ongoing support:

1. Early recognition and referral. Pharmacists can identify the prodromal signs of shingles (unilateral burning pain and vesicular rash) and advise patients to seek immediate medical attention. Prompt initiation of antivirals within 72 hours of rash onset reduces the incidence and severity of PHN. By facilitating rapid referral, pharmacists act as a critical first point of contact.

2. Vaccination counselling and administration. Pharmacists educate eligible adults (≥50 years) about the benefits of the recombinant zoster vaccine and offer vaccination services. Vaccination significantly reduces the risk of shingles and subsequent PHN. Pharmacists manage vaccine storage, administration and documentation.

3. Optimisation of analgesic therapy. Once PHN is established, pharmacists review analgesic regimens, ensure appropriate dosing of TCAs or gabapentinoids, adjust dosing schedules to minimise side effects, and counsel on gradual titration. They advise on the correct use of topical lidocaine and capsaicin preparations, which provide local pain relief with minimal systemic effects.

4. Medication review and deprescribing. Many elderly patients take multiple medications that may exacerbate PHN or cause sedation and confusion. Pharmacists perform comprehensive medication reviews, identify interactions (e.g., between TCAs and antihypertensives), and deprescribe unnecessary or harmful drugs. They reconcile medications after hospital discharge and coordinate with prescribers.

5. Patient education and self-care guidance. Pharmacists educate patients about the chronic nature of PHN, realistic pain relief goals, and the importance of adherence to therapy. They provide advice on skin care, hygiene, nutrition and stress reduction. They also teach patients to monitor for signs of secondary infection and to seek medical help when necessary.

6. Monitoring and follow-up. Regular follow-up enables pharmacists to assess pain intensity, sleep quality, mood and functionality. They monitor for adverse effects such as constipation, dizziness or cognitive impairment and adjust therapy accordingly. Pharmacists liaise with physicians to implement dose modifications or switch therapies based on patient feedback.

7. Financial and access assistance. Pharmacists help patients navigate insurance coverage, identify generic or less expensive alternatives, and access patient assistance programmes. They advocate for inclusion of antivirals, analgesics and vaccines in reimbursement lists and raise awareness of cost-effective treatment options.

8. Collaborative care. Pharmacists work within multidisciplinary teams that include physicians, nurses, physiotherapists and psychologists. They contribute to treatment planning, provide medication expertise, and ensure continuity of care through follow-up and communication with other healthcare providers.

Table 3.4 summarises pharmacist-led interventions in post-herpetic neuralgia management.

Pharmacist roles in the management of post-herpetic neuralgia are illustrated in Fig 3.2, which highlights the central role of the pharmacist in assessing medications, counselling and collaborating with prescribers during the management of post-herpetic neuralgia

Table 3.4

Pharmacist-led interventions in post-herpetic neuralgia management

Intervention	Description	Impact
Comprehensive medication review	Systematic assessment of all medications, focusing on appropriateness, interactions and renal/hepatic dose adjustments	Reduces polypharmacy, optimises therapy, improves adherence
Patient education	Counselling on disease process, treatment goals, medication use, side effects and lifestyle modifications	Improves adherence, self-management and satisfaction
Monitoring and follow-up	Regular assessment of pain intensity, functional status, adverse effects and dose titration	Enables early detection of problems; improves efficacy and safety
Non-pharmacological guidance	Recommendation of gentle exercise, cool compresses, cognitive-behavioural therapy and nutritional supplements	Enhances multimodal care; reduces medication burden
Vaccination services	Provision of shingles vaccine; documentation and reminder systems	Prevents PHN and reduces incidence of neuropathic pain
Collaboration with prescribers	Participation in pain clinics and implementation of deprescribing protocols	Facilitates coordinated, patient-centred care

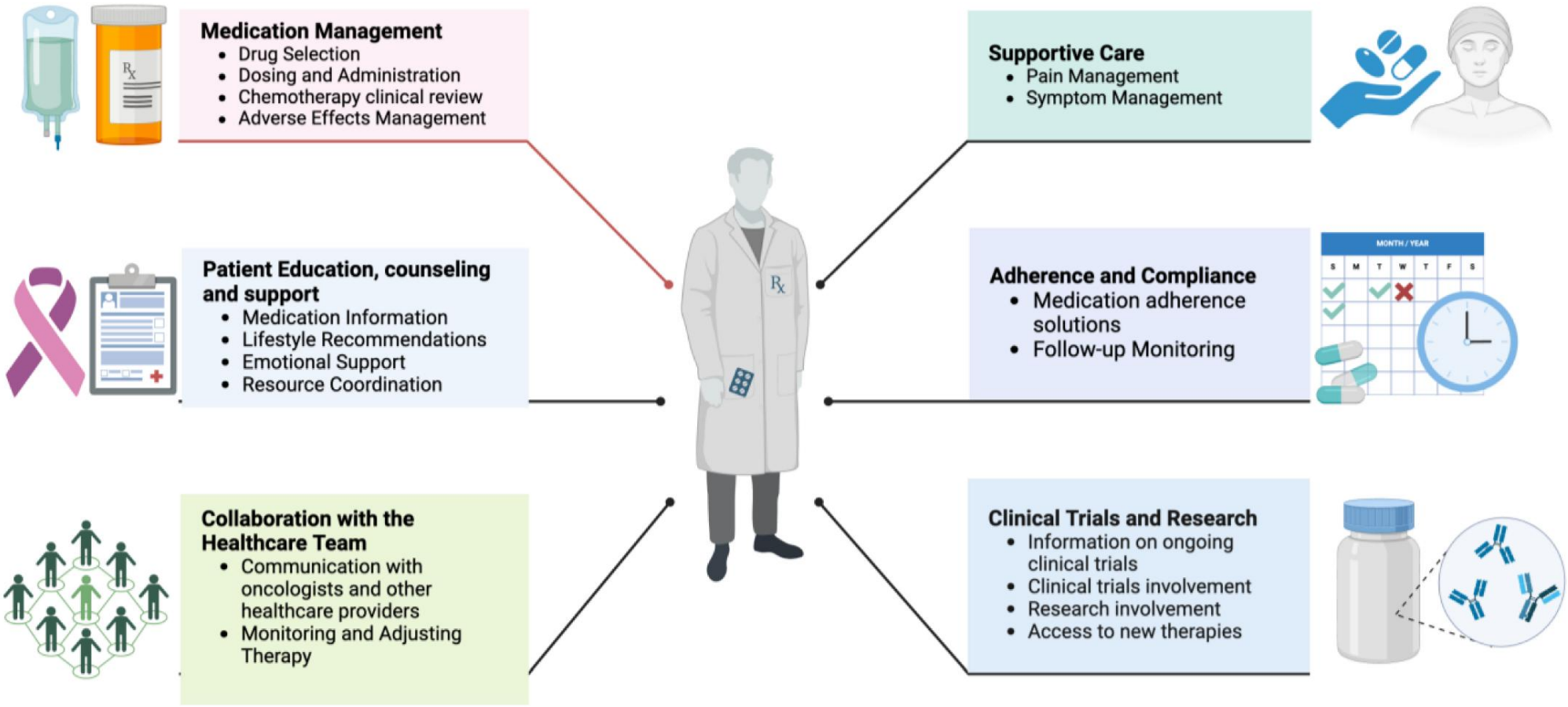

Fig 3.2 Pharmacist roles in the management of post-herpetic neuralgia

Conclusions for Chapter 3

1. Timely access to antivirals and cost-effective analgesics is crucial for preventing and managing post-herpetic neuralgia. Domestic generics of valacyclovir, famciclovir and acyclovir offer lower costs per defined daily dose than imported brands, yet total treatment costs vary widely depending on dosage and package size. Pharmacoeconomic evaluation underscores the value of early antiviral therapy and affordable first-line analgesics.

2. Vaccination with the recombinant zoster vaccine is highly effective in preventing herpes zoster and reducing the incidence of PHN, but uptake remains low due to high costs and lack of reimbursement. Comparative analysis shows that the live attenuated vaccine offers limited and short-lived protection, whereas Shingrix provides >90 % efficacy across age groups and sustained protection. Inclusion of RZV in national immunisation schedules would improve coverage and health outcomes.

3. Pharmacists play a pivotal role in the continuum of care for PHN by identifying early shingles symptoms, facilitating antiviral initiation, administering vaccines, optimising analgesic regimens and deprescribing inappropriate medications. Through patient education, monitoring and collaboration with prescribers, pharmacists enhance adherence, reduce adverse effects and support self-management. Their advocacy for cost-effective medicines and vaccines is essential for improving access and quality of care.

CONCLUSIONS

1. A theoretical review of the literature indicated that neuropathic pain affects a significant proportion of older patients (prevalence ~11–35%). Common conditions in this population include postherpetic neuralgia, diabetic peripheral neuropathy, trigeminal neuralgia and chemotherapy-induced neuropathy. NP significantly impairs patients' quality of life and imposes substantial healthcare costs.

2. It was determined that international treatment guidelines consistently recommend tricyclic antidepressants (e.g., amitriptyline), serotonin–noradrenaline reuptake inhibitors (e.g., duloxetine) and gabapentinoids (gabapentin, pregabalin) as first-line pharmacotherapy for neuropathic pain. Second-line options such as tramadol or strong opioids should be used cautiously in older patients due to the risk of adverse effects and dependence, while topical agents (lidocaine, capsaicin) and combination therapy provide additional benefit.

3. It was established that age-related physiological changes and polypharmacy require careful adjustment of treatment strategies. Lower starting doses, slow titration and regular monitoring are necessary to treat elderly patients safely, and common adverse effects (hyponatraemia, cognitive impairment, falls) must be anticipated and managed proactively.

4. It was shown that non-pharmacological interventions (exercise, cognitive-behavioral therapy, TENS, nutritional supplements) and preventive measures complement pharmacotherapy and help reduce reliance on medications. In particular, the recombinant zoster vaccine effectively prevents herpes zoster and subsequent postherpetic neuralgia in older adults.

5. It was found that pharmacists play a crucial role in managing neuropathic pain in the elderly. Through medication review, patient counseling, adherence monitoring, deprescribing of unnecessary drugs and vaccination services, pharmacists optimize treatment outcomes and reduce medication-related harm; furthermore, integrating pharmacists into multidisciplinary pain management teams enhances care quality and efficiency.

6. It is recommended to strengthen healthcare policies for NP management by improving access to cost-effective medications and integrating pharmacist-led services into primary care, alongside specialized training programs for pharmacists in pain management. Further research is needed in Ukraine to determine NP prevalence and to evaluate interventions tailored to the local context.

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Ф А 2.2.1–32-366

National University of Pharmacy

Faculty for foreign citizens' education
Department of social pharmacy

Level of higher education master

Specialty 226 Pharmacy, industrial pharmacy
Educational program Pharmacy

APPROVED
The Head of Department
of Social Pharmacy

_____
Alina VOLKOVA
"26" of February 2025

ASSIGNMENT
FOR QUALIFICATION WORK
OF AN APPLICANT FOR HIGHER EDUCATION

Ali El MOUSSAWI

1. Topic of qualification work: «Study of current approaches to pharmaceutical care in the management of neuropathic pain in elderly patients»,
supervisor of qualification work: Iryna SURIKOVA, PhD, associated professor,
approved by order of NUPh from "31th" of March 2025 № 81

2. Deadline for submission of qualification work by the applicant for higher education: October 2025.

3. Outgoing data for qualification work: data from scientific and periodical literature in accordance with research objectives; reports of international organizations, statistical data.

4. Contents of the settlement and explanatory note (list of questions that need to be developed):
- To conduct a literature review on the definition, classification and pathophysiology of neuropathic pain in the context of ageing.
- To investigate the global and national prevalence of NP and its impact on quality of life.
- To analyse current international guidelines on the treatment of NP, focusing on first-line, second-line and combination therapies and their safety profiles in older adults.
- To review non-pharmacological and adjuvant therapies applicable to elderly patients.
- To evaluate the availability of medicines, costs of treatment and health system considerations affecting access to pharmacotherapy for NP.
- To examine the role of pharmacists in the management of NP, including medication review, patient education and participation in multidisciplinary care

5. List of graphic material (with exact indication of the required drawings):
Figures – 7, Tables – 8

6. Consultants of chapters of qualification work

Chapters	Name, SURNAME, position of consultant	Signature, date	
		assignment was issued	assignment was received
1	Iryna SURIKOVA, associated professor of higher education institution of department Social Pharmacy	26.02.2025	26.02.2025
2	Iryna SURIKOVA, associated professor of higher education institution of department Social Pharmacy	28.03.2025	28.03.2025
3	Iryna SURIKOVA, associated professor of higher education institution of department Social Pharmacy	08.05.2025	08.05.2025

7. Date of issue of the assignment: «26» of February 2025.

CALENDAR PLAN

№	Name of stages of qualification work	Deadline for the stages of qualification work	Notes
1	Analysis of scientific, periodic literature on the topic of qualification work	April 2025	**done**
2	Analysis current international guidelines on the treatment of NP, focusing on first-line, second-line and combination therapies and their safety profiles in older adults	May – June 2025	**done**
3	Evaluation the availability of medicines, costs of treatment and health system considerations affecting access to pharmacotherapy for NP	September 2025	**done**
4	Examination the role of pharmacists in the management of NP, including medication review, patient education and participation in multidisciplinary care	September 2025	**done**
5	Summary of the results of the study	October 2025	**done**
6	Finalizing the work, preparing the report	October 2025	**done**

An applicant of higher education Ali El MOUSSAWI

Supervisor of qualification work Iryna SURIKOVA

ВИТЯГ З НАКАЗУ №81

По Національному фармацевтичному університету

від 31 березня 2025 року

Затвердити теми кваліфікаційних робіт здобувачам вищої освіти 5-го курсу Фм21*(4,10д) 2025-2026 навчального року, освітньо-професійної програми – Фармація, другого (магістерського) рівня вищої освіти, спеціальності 226 – Фармація, промислова фармація, галузь знань 22 Охорона здоров'я, денна форма здобуття освіти (термін навчання 4 роки 10 місяців), які навчаються за контрактом (мова навчання англійська).

Прізвище, ім'я здобувача вищої освіти	Тема кваліфікаційної роботи		Посада, прізвище та ініціали керівника	Рецензент кваліфікаційної роботи
• **по кафедрі соціальної фармації**				
Альмуссаві Алі	Вивчення сучасних підходів до фармацевтичної допомоги при лікуванні нейропатичного болю у пацієнтів літнього віку	Study of current approaches to pharmaceutical care in the management of neuropathic pain in elderly patient	доц. Сурікова І.О.	доц. Отрішко І.В.

Ректор

Вірно. Секретар

ФА2.8-03-317

ВИСНОВОК

експертної комісії про проведену експертизу
щодо академічного плагіату у кваліфікаційній роботі
здобувача вищої освіти

«21» листопада 2025 р. № 332672885

Проаналізувавши кваліфікаційну роботу здобувача вищої освіти АЛЬМУССАВІ Алі, групи Фм21*(4,10д)-01, спеціальності 226 Фармація, промислова фармація, освітньої програми «Фармація» очної (денної) форми навчання на тему: «Вивчення сучасних підходів до фармацевтичної допомоги при лікуванні нейропатичного болю у пацієнтів літнього віку / Study of current approaches to pharmaceutical care in the management of neuropathic pain in elderly patient», експертна комісія дійшла висновку, що робота, представлена до Екзаменаційної комісії для захисту, виконана самостійно і не містить елементів академічного плагіату (компіляції).

В.о. ректора НФаУ,
професор Олександр КУХТЕНКО

REVIEW

of scientific supervisor for the qualification work of the master's level of higher education of the specialty 226 Pharmacy, industrial pharmacy

Ali El MOUSSAWI

on the topic: «Study of current approaches to pharmaceutical care in the management of neuropathic pain in elderly patients»

Relevance of the topic. Neuropathic pain represents a major and increasing clinical challenge, particularly among elderly patients, where its prevalence ranges from 11% to 35%. Conditions such as post-herpetic neuralgia, diabetic peripheral neuropathy, trigeminal neuralgia and chemotherapy-induced neuropathy contribute to reduced quality of life, functional decline and increased healthcare utilisation. In this context, the investigation of modern approaches to pharmaceutical care, optimisation of pharmacotherapy in older adults and the expanding role of pharmacists is timely, socially important and aligned with current global public health priorities.

Practical value of conclusions, recommendations and their validity. The qualification work offers a comprehensive and well-structured analysis of evidence-based treatment guidelines, pharmacological and non-pharmacological management strategies, and the accessibility of medicines used in neuropathic pain and post-herpetic neuralgia. The conclusions are logically derived from the research results and hold practical significance for improving pharmaceutical care services, promoting rational pharmacotherapy, enhancing patient counselling and supporting vaccination strategies. The material can be applied in clinical pharmacy practice, healthcare planning and further professional training.

Assessment of work. During the preparation of the qualification work, the student demonstrated a high level of responsibility, analytical thinking and the ability to work effectively with scientific literature, clinical guidelines and statistical data. The work is logically structured, clearly presented and methodologically sound. The student showed independence in formulating conclusions, critically evaluating sources and

integrating multidisciplinary aspects of pharmaceutical care. The graphical materials, tables and analytical comparisons are relevant and well interpreted.

General conclusion and recommendations on admission to defend. In general, the qualification work of Ali El MOUSSAWI on the topic «Study of current approaches to pharmaceutical care in the management of neuropathic pain in elderly patients» is performed at the proper level, meets the requirements of the "Regulations on the preparation and protection of qualification works at the National University of Pharmacy" and can be recommended for defense in the Examination commission.

Scientific supervisor Iryna SURIKOVA

«21th» of November 2025

Ф А 2.2.1-32-356

REVIEW

for qualification work of the master's level of higher education, specialty 226 Pharmacy, industrial pharmacy

Ali El MOUSSAWI

on the topic: «Study of current approaches to pharmaceutical care in the management of neuropathic pain in elderly patients»

Relevance of the topic. The topic of the qualification work is undoubtedly relevant, since neuropathic pain represents a significant clinical, social and economic burden, particularly among elderly patients. The rising incidence of post-herpetic neuralgia, diabetic peripheral neuropathy, trigeminal neuralgia and chemotherapy-induced neuropathy underscores the need for evidence-based pharmaceutical care approaches. The work justifiably emphasises the essential role of pharmacists in medication management, patient counselling, prevention of drug-related problems and support of vaccination strategies. Studying pharmaceutical care in this context contributes to improving treatment outcomes, reducing complications and optimising the use of healthcare resources.

Theoretical level of work. The qualification work is based on an extensive study of scientific literature, clinical guidelines and statistical materials. The author systematically analysed publications of domestic and international researchers, summarised current scientific data and structured findings in a logical and coherent manner. The theoretical framework is sound, and the methodology corresponds to the stated aim and objectives of the work. The results presented in the thesis are well-substantiated, methodologically consistent and do not raise doubts regarding their scientific validity and reliability.

Author's suggestions on the research topic. The author provides a comprehensive analysis of modern pharmaceutical care approaches for elderly patients with neuropathic pain, focusing particularly on post-herpetic neuralgia. The work includes evaluation of medicine availability, review of cost-effectiveness data, assessment of treatment guidelines, and identification of key factors affecting pharmacotherapy

safety in older adults. Special attention is given to the evolving role of pharmacists in prevention, early intervention, optimisation of analgesic therapy, deprescribing, vaccination services and multidisciplinary collaboration. These suggestions are grounded in current evidence and contribute to improving pharmaceutical practice.

Practical value of conclusions, recommendations and their validity. The acquaintance with the qualification work confirms the practical significance of the conducted research. The recommendations provided by the author are relevant, feasible and can be applied in community and clinical pharmacy settings, as well as in educational programmes for pharmacists. The conclusions are consistent with the presented data, clearly formulated and supported by analysed sources.

Disadvantages of work. Minor typos and grammatical errors are present in the text.

General conclusion and assessment of the work. According to the relevance and the results of the research qualification work of Ali El MOUSSAWI on the topic «Study of current approaches to pharmaceutical care in the management of neuropathic pain in elderly patients» meets the requirements for master's works and can be recommended for official defense in the Examination commission.

Reviewer Associate professor Inna OTRISHKO

«21th» of November 2025

ВИТЯГ
з протоколу засідання кафедри соціальної фармації
№ 7 від «21» листопада 2025 року

ПРИСУТНІ: зав. каф. доц. Волкова А.В., доц. Болдарь Г.Є., доц. Дядюн Т.В., доц. Міщенко В.І., проф. Назаркіна В.М., доц. Ноздріна А.А., проф. Панфілова Г.Л., доц. Сурікова І.О., доц. Терещенко Л.В.

ПОРЯДОК ДЕННИЙ: Про представлення до захисту в Екзаменаційній комісії кваліфікаційних робіт.

СЛУХАЛИ: завідувачку кафедри доц. Волкову А. В. з рекомендацією представити до захисту в Екзаменаційній комісії кваліфікаційну роботу здобувача вищої освіти спеціальності 226 Фармація, промислова фармація Альмуссаві Алі на тему: «Вивчення сучасних підходів до фармацевтичної допомоги при лікуванні нейропатичного болю у пацієнтів літнього віку».

Науковий керівник: к. фарм. н., доцент кафедри СФ Сурікова І.О.

Рецензент: к. фарм. н., доцент кафедри КфКф Отрішко І.В

ВИСТУПИЛИ: проф. Назаркіна В.М., проф. Панфілова Г.Л. доц. Терещенко Л.В., висловили рекомендації до кваліфікаційної роботи Альмуссаві Алі

УХВАЛИЛИ: Рекомендувати до захисту в Екзаменаційній комісії кваліфікаційну роботу здобувача вищої освіти Альмуссаві Алі на тему: «Вивчення сучасних підходів до фармацевтичної допомоги при лікуванні нейропатичного болю у пацієнтів літнього віку»

Завідувачка каф. СФ, доцент _____ Аліна ВОЛКОВА

Секретар, доцент _____ Альміра НОЗДРІНА

Ф А2.2.1-32-042

НАЦІОНАЛЬНИЙ ФАРМАЦЕВТИЧНИЙ УНІВЕРСИТЕТ

ПОДАННЯ
ГОЛОВІ ЕКЗАМЕНАЦІЙНОЇ КОМІСІЇ
ЩОДО ЗАХИСТУ КВАЛІФІКАЦІЙНОЇ РОБОТИ

Направляється здобувач вищої освіти Алі Альмуссаві до захисту кваліфікаційної роботи за галуззю знань 22 Охорона здоров'я
спеціальністю 226 Фармація, промислова фармація
освітньою програмою Фармація
на тему: «Вивчення сучасних підходів до фармацевтичної допомоги при лікуванні нейропатичного болю у пацієнтів літнього віку».

Кваліфікаційна робота і рецензія додаються.

Декан факультету _____ / Олександр ГОНЧАРОВ/

Висновок керівника кваліфікаційної роботи

Здобувач вищої освіти Алі АЛЬМУССАВІ під час виконання кваліфікаційної роботи продемонструвала уміння працювати з науковими даними, проводити їх узагальнення, аналізувати та узагальнювати результати дослідження. Усі поставлені завдання відповідно до мети роботи було виконано у повному обсязі. Результати дослідження належним чином оброблені і представлені.

Таким чином, кваліфікаційна робота може бути рекомендована до офіційного захисту в Екзаменаційній комісії Національного фармацевтичного університету.

Керівник кваліфікаційної роботи Ірина СУРІКОВА

«21» листопада 2025 р.

Висновок кафедри про кваліфікаційну роботу

Кваліфікаційну роботу розглянуто. Здобувач вищої освіти Алі АЛЬМУССАВІ допускається до захисту даної кваліфікаційної роботи в Екзаменаційній комісії.

Завідувачка кафедри
соціальної фармації Аліна ВОЛКОВА

«21» листопада 2025 р.

Qualification work was defended

of Examination commission on

« » November 2025

With the grade _____

Head of the State Examination commission,

DPharmSc, Professor

_____ / Volodymyr YAKOVENKO/