

# Economic impact of shifting the locus of care for neuropathic pain from specialists to general practitioners

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**Abstract** We developed a decision-analytic model to examine the economic impact of shifting the locus of care for patients with painful neuropathies from specialists to GPs. The impetus for such a shift was assumed to be a formal education program, focusing on the recognition and treatment of neuropathic pain, conducted for GPs. In the model, all patients with neuropathic pain were assumed to initiate care with their GPs and then be referred to specialists and, ultimately, pain clinics as required for adequate pain control. Two alternative scenarios were examined—the “current” arrangement in which most patients were assumed to be referred for treatment by specialists and pain clinics and a “hypothetical” arrangement in which GPs were assumed to play an expanded role in the treatment of neuropathic pain and which, therefore, often precluded the need for referral. The model was populated with clinical, epidemiologic, and economic data from Norway. A total of 34,951 persons in Norway were estimated to seek care for painful neuropathies each year. The formal education program was assumed to cost 1.5 million Kroner (NOK). Shifting the locus of care from specialists to GPs would result in 4,715 additional GP visits, but 12,123 fewer specialist visits and 7,967 fewer visits to pain clinics. This change would

result in estimated savings to the Norwegian health-care system in 2004 of 74.1 million NOK (approx. US \$11.9 million). A partial shift in the locus of care of painful neuropathies from specialists to GPs may result in substantial cost savings to the Norwegian health-care system.

**Keywords** Clinical practice patterns · Cost and cost analyses · Neuralgia

## Introduction

Neuropathic pain is caused by dysfunction of the peripheral nerves or, less commonly, the central nervous system. Common causes of neuropathic pain include diabetes (diabetic peripheral neuropathy, DPN), herpes zoster (post-herpetic neuralgia, PHN), acquired immune deficiency syndrome (AIDS), and mechanical pressure on the nerve body [1, 2]. Neuropathic pain is debilitating in nature; in one survey of 385 persons aged  $\geq 65$  years with PHN, 40% of respondents reported that shingles pain moderately to severely interfered with their general activities, and nearly one-half reported that their enjoyment of life was moderately to severely affected [3]. Patients with neuropathic pain also often suffer from depression, anxiety, and sleep disturbance [1, 2, 4–7].

“Traditional” analgesic agents, for example non-steroidal anti-inflammatory drugs (NSAIDs) and opioids, are, unfortunately, often ineffective in the treatment of neuropathic pain [8–17]. Effective management of neuropathic pain therefore often involves use of nontraditional analgesics, medications labeled “adjuvant” by the World Health Organization (e.g.

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antiepileptics, tricyclic antidepressants) [18]. These drugs are, unfortunately, no panacea for neuropathic pain, and, like their more traditional counterparts, have had varied success. Adjuvant medications are, moreover, typically used at dosages and/or intervals that differ from those specified for their other, better known indications (e.g. the effective daily dose of gabapentin in epilepsy is 900–1,800 mg three times daily (TID) [19–22] whereas in PHN, it is 1,800–3,600 mg TID [6, 23]). These higher dosages may be associated with a greater incidence of side effects. Thus, the treatment of neuropathic pain can be quite complex and often involves finding an acceptable balance between efficacy and tolerability.

As a consequence of the complexity of treatment, patients with neuropathic pain are often referred by their general practitioners (GPs) to specialists (e.g. neurologists, anesthesiologists). Specialist care can be costly, however. If GPs were better able to treat neuropathic pain, savings to the healthcare system might ensue. We developed a decision–analytic model to examine the economic implications of such a shift in the locus of care. The model was then populated with data specific to Norway to estimate the impact of such a shift in patterns of care in this setting.

## Methods

### Model structure

We developed a decision–analytic model [24] to examine expected outcomes and costs associated with the treatment of painful neuropathies. The model was used to estimate the economic impact of shifting the locus of care for patients with neuropathic pain in Norway from specialists to GPs. In the model, all patients were assumed to initiate care with a visit to their GP (Fig. 1). After this initial visit it was assumed some

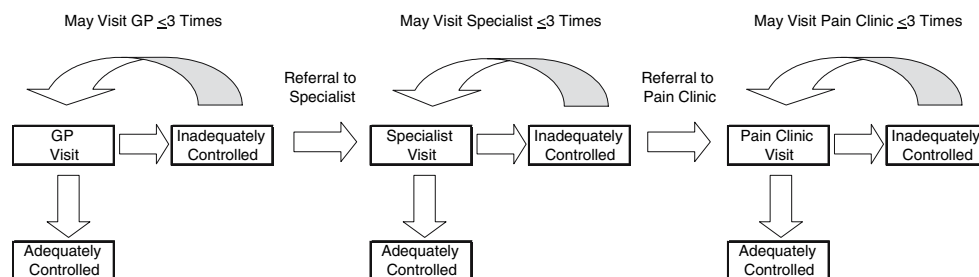
patients would achieve adequate control of their pain (operationally defined as not requiring further physician treatment for pain) whereas others would not. Patients with inadequately controlled pain were assumed either to be seen again by their GP or referred to a specialist. Similarly, patients whose pain remained inadequately controlled after a specialist visit were assumed either to be seen again by the specialist or referred to a pain clinic. Patients were assumed to visit each type of provider (GP, specialist, pain clinic) a maximum of three times after which they would be referred to the next level of care if their pain remained inadequately controlled. All patients were assumed ultimately to achieve adequate pain control after a maximum of nine visits, and to leave the model when such control was achieved. The model was run under two alternative scenarios:

1. a “current” scenario, assumed to approximate current treatment patterns; and
2. a “hypothetical” scenario, in which the locus of care was assumed to be shifted to GPs.

Irrespective of the setting of care and the scenario, adequate pain control was assumed to impart the same benefit to the patient; the model therefore estimates the economic consequences of a shift in the locus of care that might occur if the likelihood of achieving adequate pain control under the care of GPs relative to specialists was increased.

### Model population

The prevalence of painful neuropathic disorders in persons  $\geq 18$  years has been estimated to be 1% [26–28]. We therefore estimated that 34,951 Norwegians would experience neuropathic pain in the calendar year (CY) 2004 (i.e.  $0.01 \times 3,495,131$ , which is the population of Norway aged  $\geq 18$  years [24]).



**Fig. 1** Schematic diagram of the model. Patients are assumed to be referred hierarchically: GPs refer patients to specialists; specialists refer patients to pain clinics. Patients may achieve

adequate control of their pain at any given visit to any given provider. Patients are assumed to leave the model when their pain was adequately controlled

## Estimation of variables

Default estimates of most of the variable in the model were obtained from two surveys of Norwegian physicians, one of GPs and the other of specialists (“GP Survey” and “Specialist Survey”, respectively). Both surveys were designed to assess treatment strategies for neuropathic pain (including use of different pharmacotherapies) and referral patterns for neuropathic pain. From a list of all registered GPs practicing in Norway, 40 were randomly selected. The corresponding number for specialists (i.e. pain specialists, diabetologists, neurologists) was 21. Participating physicians were surveyed by trained interviewers in August and September of 2003. All participating physicians were given an honorarium of 150 NOK.

The probability of receiving different health-care services during each visit is shown in Table 1; we assumed that answers obtained from the specialist survey were generalizable to pain clinics.

Because neuropathic pain is difficult to treat, we arbitrarily assumed that only 25% of patients treated with pharmacotherapy would achieve adequate pain control after any given visit to a GP; corresponding values for specialists and pain clinics were 35 and 40%, respectively, reflecting assumed greater experience with neuropathic pain and its treatment (Table 2). In

the hypothetical scenario, we not only assumed that the percentages of patients achieving adequate pain control at any given GP, specialist, or pain clinic visit would increase as a result of a formal state-sponsored GP education program and/or improvements in diagnostic and treatment options, but also that the “gap” between GPs and specialists/pain clinics in treatment success would diminish, because GPs would probably derive somewhat greater benefit than specialists or pain clinics. We arbitrarily assumed that, irrespective of provider or scenario, only 12.5% of patients not receiving pharmacotherapy would achieve adequate pain control after any given visit.

Numbers of referrals for each type of provider were derived from responses of GPs and specialists to the surveys and are listed in Table 3. Because the survey did not ascertain the number of GP visits before referral, we assumed a constant rate after each of the first two GP visits. Referrals to pain clinics by specialists were not addressed in the survey; referrals by specialists to the emergency department (ED) (10.5%) and to hospital (14.0%) were, however. We assumed that the percentage of patients referred by their GPs to specialists and by their specialists to pain clinics would be approximately halved under the “hypothetical” scenario.

The costs of visits and health-care services are listed in Table 4. Costs of provider visits were estimated using data from the Norwegian Medical Association [29]. Published estimates of the costs of health-care services are not available; accordingly, one of the study’s authors (GSK) reviewed cost estimates for these services with Norwegian pain specialists to check their reasonability. Patients were assumed to have a co-pay of 47 NOK per laboratory test and 185 NOK per diagnostic test; values listed in Table 4 are adjusted for these co-pays. We assumed a formal, state-sponsored, education program consisting of two 45-min sessions would be offered to all Norwegian GPs. Each session was assumed to educate 30 GPs; because there were 4,150 GPs practicing in Norway in CY 2004 [25], we estimated it would take 139 sessions to provide such education at a cost of 8,000 NOK per session. In addition to the cost per session, we assumed each GP would receive a booklet at the conclusion of the program that set forth guidelines for recognition and treatment of neuropathic pain at a cost of 100 NOK per booklet; the total cost of the program was therefore assumed to be 1,527,000 NOK. The costs of health-care services and the intervention were assumed to include wages only; other components of cost (e.g. overhead, capital costs) were not included. All costs were assumed to be equivalent to those paid by the Norwegian government in CY 2004.

**Table 1** Use of pharmacological and non-pharmacological management strategies and other health-care services to treat neuropathic pain, by setting

	Setting of care		
	GP <sup>a</sup>	Specialist	Pain clinic
Management option			
Pharmacological	74.0	77.0	77.0
Non-pharmacological	26.0	23.0	23.0
Utilization of health-care services per visit			
CT Scan	0.0	32.5	32.5
MRI	0.0	46.6	46.6
Nerve conduction test	0.0	26.6	26.6
Quantitative sensory test	0.0	21.9	21.9
Ultrasound	0.0	8.7	8.7
EMG	0.0	14.8	14.8
Physiotherapy	36.0	47.6	47.6
TENS	13.0	57.1	57.1
Acupuncture	2.0	28.6	28.6

Values are given as percentage of patients

Use of management strategies and health-care services are assumed to not differ by scenario

GP, general practitioner; CT, computed tomography; MRI, magnetic resonance imaging; EMG, electromyography; TENS, transcutaneous electrical nerve stimulation

<sup>a</sup> In Norway, GPs do not order CT scans, nerve conduction tests, qualitative sensory tests, ultrasound treatment, or EMGs

**Table 2** Proportion of patients achieving adequate pain control per visit, by setting of care and treatment scenario

Management option	Setting of care					
	Current scenario			Hypothetical		
	GP	Specialist	Pain clinic	GP	Specialist	Pain clinic
Pharmacological	25.0	35.0	40.0	35.0	40.0	45.0
Non-pharmacological	12.5	12.5	12.5	12.5	12.5	12.5

Values are given as percentage of patients

GP, general practitioner

**Table 3** Proportion of patients referred to alternative setting of care, by treatment scenario

Referred	Treatment scenario	
	Current	Hypothetical
To pain specialist		
After first GP visit	33.3	17.3
After second GP visit	33.3	17.3
After third GP visit	100.0	100.0
To pain clinic		
After first specialist visit	10.5	6.0
After second specialist visit	14.0	8.0
After third specialist visit	100.0	100.0

Values are given as percentage of patients

GP, general practitioner

## Analyses

We estimated the annual number of visits to GPs, specialists, and pain clinics (and the costs thereof) by

**Table 4** Costs of health-care visits and services

	Cost (NOK)
Visits	
GP	
Initial	125
Subsequent	125
Specialist	
Initial	245
Subsequent	245
Pain clinic	
Initial	245
Subsequent	245
Health-care services	
CT scan	3,565
MRI	3,565
Nerve conduction test	565
Quantitative sensory test	565
Ultrasound	565
EMG	565
Physiotherapy	400
TENS	100
Acupuncture	400

GP, general practitioner; CT, computed tomography; MRI, magnetic resonance imaging; EMG, electromyography; TENS, transcutaneous electrical nerve stimulation

patients with neuropathic pain under the “current” and the “hypothetical” scenarios.

A variety of one-way sensitivity analyses were conducted, in which the following estimates were varied by  $\pm 25\%$ :

1. the number of patients with painful neuropathies receiving pharmacotherapy;
2. the number of patients achieving adequate pain control after each visit;
3. the number of patients with inadequately controlled pain referred after each visit;
4. the probability that different tests and services will be ordered at each visit; and
5. the unit costs of tests, services, and office visits.

We also varied referral rates to their extremes, assuming first that all patients with inadequately managed pain would be referred immediately (100% likelihood of referral) and, second, that patients would be referred only after their third visit to each provider. Finally, we examined two “extreme” scenarios in which we assumed alternatively that:

1. only referral rates change (i.e. no change in the probability of adequate pain control after each visit); and
2. only the probability of adequate pain control after each visit changes (i.e. there is no change in the rate of referral).

## Results

A total of 34,951 persons in Norway are expected to seek treatment for painful neuropathic disorders in any year. Under the current scenario these patients are expected to generate 62,714 GP visits, 42,773 specialist visits, and 17,990 visits to pain clinics (Table 5); corresponding values under the hypothetical scenario are 67,430, 30,651, and 10,023 respectively. Compared with

the current scenario, shifting the locus of care from specialists and pain clinics to GPs was expected to result in savings to the Norwegian health-care system in 2004 of 74.1 million NOK (approx. US \$11.9 million) (251.1 compared with 175.7 million NOK) (Table 6).

Results of one-way sensitivity analyses suggest the model is extremely sensitive to changes in unit costs, utilization of tests/services at each visit, the number of patients achieving adequate pain control after each visit, and the number of patients receiving pharmacotherapy. The model is relatively insensitive to modest variations (e.g.  $\pm 25\%$ ) in referral rate but extremely sensitive to extreme variation in this rate (e.g. 0 or 100% referral rate after each visit) (Fig. 2). Running the model with the assumption that referral rates would change but the likelihood of adequate pain control after each visit would not change yielded estimated savings of 37.8 million NOK (approx. US \$6.0 million); running the model with the assumption that the likelihood of adequate pain control would change but that referral rates after each visit would not change yielded estimated savings of 53.8 million NOK (approx. US \$8.6 million).

## Discussion

Our findings suggest that improving care of neuropathic pain in a GP setting may result in substantial cost savings. In our basecase analysis, an absolute increase of 10% (from 25 to 35%) in the likelihood of

**Table 5** Expected health-care utilization, by scenario

	Number		
	Current scenario	Hypothetical scenario	Difference
Visits			
GP	62,714	67,430	4,715
Specialists	42,773	30,651	(12,123)
Pain clinic	17,990	10,023	(7,967)
Tests and other services			
CT scan	19,748	13,219	(6,529)
MRI	28,316	18,954	(9,362)
Nerve conduction test	16,163	10,819	(5,344)
Quantitative sensory test	13,307	8,907	(4,400)
Ultrasound	5,286	3,539	(1,748)
EMG	8,993	6,020	(2,973)
Physiotherapy		43,635	(7,865)
TENS	42,849	31,990	(10,858)
Acupuncture	18,633	12,981	(5,651)

Negative values (shown parenthetically) denote expected savings  
GP, general practitioner; CT, computed tomography; MRI, magnetic resonance imaging; EMG, electromyography; TENS, transcutaneous electrical nerve stimulation

**Table 6** Expected health-care costs, by scenario

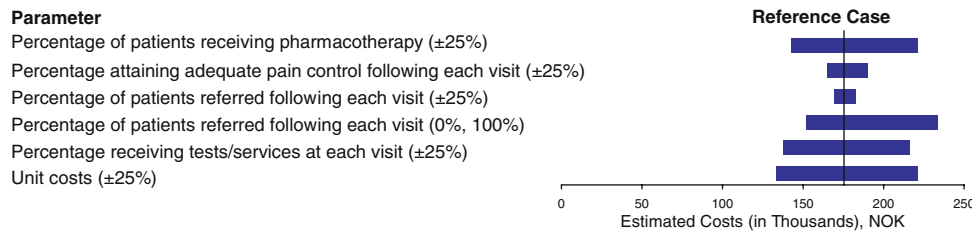
	Costs (NOK)		
	Current scenario	Hypothetical scenario	Difference
Visits			
GP	7,839,298	8,428,696	589,397
Specialists	10,479,465	7,509,384	(2,970,081)
Pain clinic	4,407,526	2,455,626	(1,951,900)
Total visits	22,726,289	18,393,705	(4,332,584)
Tests and other services	228,403,700	157,087,438	(71,316,262)
Physician education program	0	1,527,000	1,527,000
Total costs	251,129,989	177,008,143	(74,121,846)

Negative values (shown parenthetically) denote expected savings  
GP, general practitioner

adequate pain control after each GP visit, and the corresponding reduced rate of referral from GPs to specialists and from specialists to pain clinics it would engender, would be associated with a reduction in health-care spending by the Norwegian government of approximately 74 million NOK, or approximately 2,117 NOK per patient with neuropathic pain (approx. US \$338). To the best of our knowledge our research is the first attempt to quantify the magnitude of direct medical-care cost savings possible by shifting the locus of care of neuropathic pain from specialists to GPs.

Savings estimated by our model are generated primarily by increasing the likelihood of adequate management and reducing the likelihood of referral at the GP level. For example, when we considered a scenario where access to specialist and pain clinics was limited (i.e. 0% likelihood of referral until after the third visit) *without* a corresponding change in the likelihood of adequate pain control, savings to the Norwegian health-care system were estimated to be 37.8 million NOK (approx. US \$6 million). Although such a scenario is unrealistic, it indicates the savings possible by simply shifting care to less costly levels. Results from our model therefore suggest that were GPs to become more comfortable with treating neuropathic pain—even if such treatment was no more effective than that currently available—substantial savings may be achieved. The magnitude of the savings was sensitive to unit costs of visits and services, patterns of utilization associated with treatment of neuropathic pain, and the number of patients managed with pharmacotherapy (and who are therefore assumed to have at least a twofold greater chance of achieving adequate pain control after any given provider visit).

We note that our model focuses on savings to the health-care system only (i.e. direct medical-care costs



**Fig. 2** Results from one-way sensitivity analysis. Bars represent the range of one-way sensitivity analysis, values in parentheses indicate ranges of each variable used in these analyses. All values

payable to providers by the Norwegian government). Additional benefits may accrue from shifting care from specialists and pain clinics to GPs (e.g. productivity loss). For example, patients typically have to wait longer to see specialists than GPs. Additional waiting time may be associated with reduced productivity and greater suffering by the patient. Because GPs are most familiar with patients and their families, they should be able to provide more comprehensive care in a timely manner.

Our findings are not without limitations. First, our assumptions about the likelihood of adequate pain control after each GP, specialist, and pain clinic visit were speculative. Neuropathic pain is difficult to treat, and both pharmacological and non-pharmacological interventions are used. Published estimates of adequate pain control among patients with painful neuropathies are typically agent and indication-specific. We therefore had to estimate the likelihood of adequate pain control given pharmacological and non-pharmacological management in the absence of published estimates. We assumed that specialists/pain clinics would have greater expertise than GPs in dosing and titrating pharmacotherapy and therefore assigned a greater likelihood of pain control after a visit to the former compared with the latter.

Second, we assumed that relative to the current scenario, GPs would derive greater benefit in the hypothetical scenario than either specialists or pain clinics. The basis of this assumption is our belief that GPs are more likely to benefit than specialists and pain clinics from expanded education, diagnostic tools, and treatment options for neuropathic pain.

Third, because our model did not include the costs of pharmacotherapy, the results obtained undoubtedly overestimate the magnitude of savings associated with shifting the locus of care to GPs. We doubt, however, that including the costs of drugs, which are presumably prescribed by all providers, would substantially negate savings estimated from reducing the frequency of use of costly health-care services, for example CT scans

and MRIs, which in Norway are ordered by specialists only.

Finally, we assumed that patients would have a maximum of three visits to any given type of provider and that all patients would achieve adequate pain control by the ninth visit (i.e. after three GP visits, three specialist visits, three pain clinic visits). In fact, patients may require more than nine visits to achieve adequate control of their pain and, as responses to the physician surveys indicate, may require ED visits and/or hospital admissions for additional treatment. Both of these are substantially more costly than the levels of care included in the model. Our findings therefore may be conservative.

## Conclusions

Our findings indicate that a partial shift in the locus of care of painful neuropathies from specialists to GPs may result in substantial cost savings to the Norwegian health-care system.

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