Socioeconomic deprivation independently predicts symptomatic painful diabetic neuropathy in people with type 2 diabetes

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Article points

1. In this study, a significant independent association between social disadvantage and a greater likelihood of painful diabetic peripheral neuropathy was observed.
2. This was independent of glycaemic control and suggests that lifestyle factors may play a role in the aetiology of neuropathic pain independent of their influence on metabolic control.
3. Targeted allocation of healthcare resources may be required in areas of relative disadvantage in order to prevent and treat painful neuropathy.

Key words

- Diabetic neuropathy
- Foot complications
- Primary care
- Type 2 diabetes

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Painful diabetic neuropathy has previously been observed in 20% of the population with type 2 diabetes in northwest England, and has also been independently associated with socioeconomic disadvantage in people with type 1 diabetes. In this community-based study, the authors sought to determine the association between painful neuropathy and socioeconomic deprivation in people with type 2 diabetes. Overall, 21% of the cohort had painful diabetic neuropathy requiring treatment. Each unit increase in Townsend deprivation index score was associated with a 6% increase in the risk of painful neuropathy, and neuropathy was also associated with age and BMI. The results support the previous findings in people with type 1 diabetes and suggest a need for targeted allocation of healthcare resources in areas of relative disadvantage.

Peripheral neuropathy is a common microvascular complication of diabetes, the incidence of which increases with age and with poor glycaemic control. Diabetic neuropathy is the most common form of neuropathy in the western world (Young et al, 1993; Pop-Busui et al, 2009). Diabetic peripheral neuropathy increases the risk of recurrent lower extremity infections and ulceration, and is a major contributor to non-traumatic lower extremity amputations (implicated in more than 60% of cases; Tesfaye et al, 1996; Abbott et al, 2011).

Painful diabetic peripheral neuropathy is a debilitating condition with adverse psychological and occupational implications. A previous study in northwest England showed that an estimated 35% of the population with type 2 diabetes had painful symptoms, with the prevalence of painful diabetic peripheral neuropathy being 21% (Tesfaye et al, 1996).

We have previously demonstrated an independent relationship between social disadvantage and prescriptions for painful diabetic neuropathy in people with type 1 diabetes (Anderson et al, 2014). In the current community-based study, we investigated the prevalence of symptomatic diabetic neuropathy in relation to indices of socioeconomic deprivation in people with type 2 diabetes from the county of Cheshire. We also analysed prescription trends with respect to pharmacotherapy for neuropathy pain relief in this population.

Methods

We examined pseudo-anonymised records in 15 387 people with type 2 diabetes attending general practices in the catchment area of our service in Central and Eastern Cheshire Primary Care Trust. We included all individuals with type 2 diabetes who were on our register in early 2012. Overall, 6770 participants (44.1%) were women and the mean age was 67 years (range, 16–101 years).

We used the Townsend deprivation index (Townsend et al, 1987), based on participants' postcode, to assess socioeconomic deprivation. This

index was devised to provide a material measure of deprivation and disadvantage in a population, and scores were derived from census variables taken originally from the 1991 UK Census. More positive Townsend scores are associated with geographical areas with high deprivation. Negative values are associated with relative affluence.

Results

Symptomatic neuropathic pain of a degree requiring pharmacological treatment was present in 3266 participants (21.2%), of whom 973 (6.3% of the total cohort) had a formal diagnosis of peripheral neuropathy recorded. The agents prescribed are shown in *Table 1* and *Figure 1*. Specifically, 2162 participants were prescribed one agent, 756 received two, 263 received three and 85 received four or more.

Of the 15 387 individuals with type 2 diabetes, 2748 (17.9%) had a diagnosis of either depression or mixed depression and anxiety disorder. Of the 3266 people receiving pharmacological treatment

Table 1. Pain relief drug prescriptions in 3266 participants.

Drug	Dose range	Proportion of participants prescribed
Amitriptyline	10–75 mg/day	52.6%
Tramadol	10–300 mg/day	40.9%
Gabapentin	100–800 mg/day	21.9%
Pregabalin	25–300 mg/day	11.1%
Carbamazepine	100–800 mg/day	7.3%
Duloxetine	20–60 mg/day	4.8%
Nortriptyline	10–25 mg/day	3.2%
Imipramine	10–25 mg/day	2.6%
Capsaicin cream	0.025–0.075%	3.5%

Note: Some participants received more than one agent.

Page points

1. Of the study cohort of 15 387 people with type 2 diabetes, 3266 (21.2%) had neuropathic pain requiring treatment.
2. The second most common treatment prescribed was tramadol, despite the fact that this agent is not recommended by NICE for the long-term management of neuropathic pain.

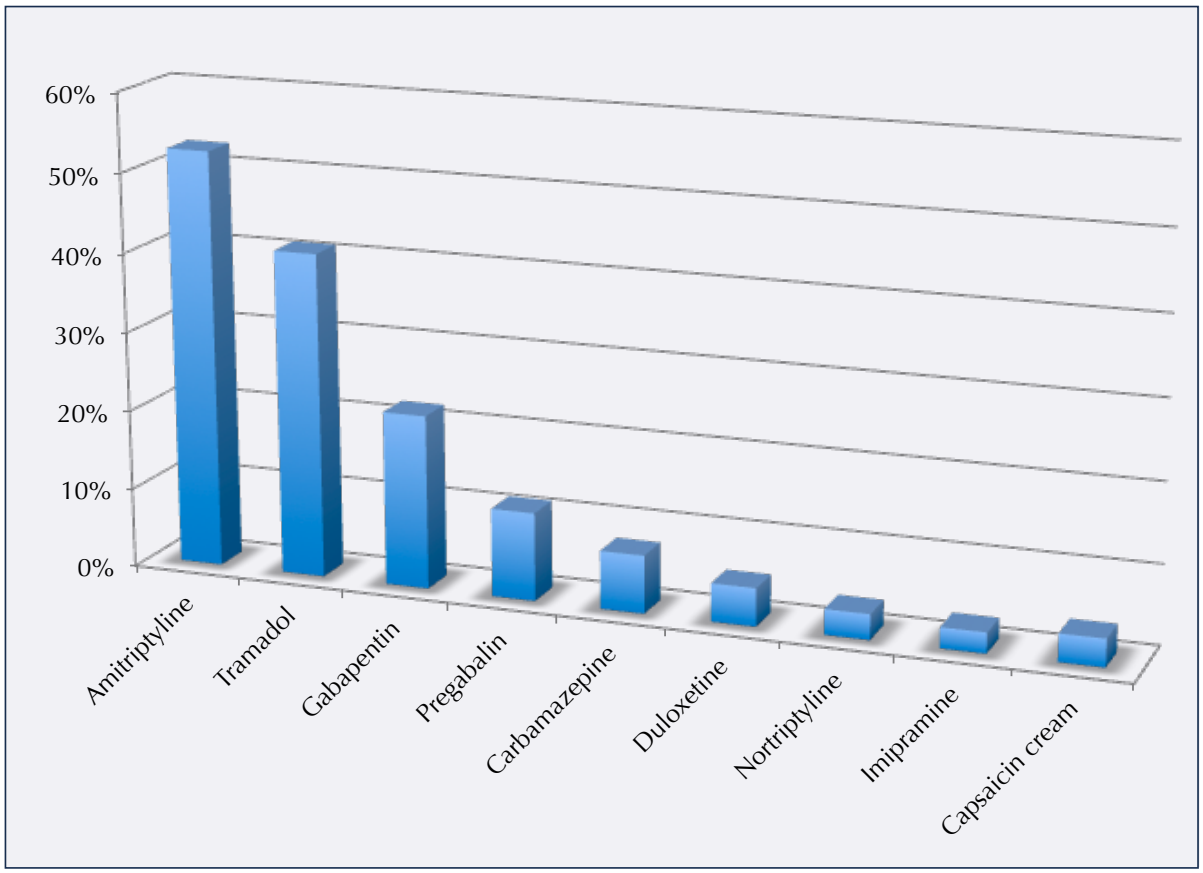

Figure 1. Proportion of participants prescribed each agent (includes combination therapies).

Page points

1. Higher Townsend scores, indicating greater socioeconomic deprivation, were associated with a greater likelihood of receiving treatment for painful neuropathy.
2. In both univariate and multivariate analyses, each unit increase in Townsend index score was associated with a 6% increased risk of having painful neuropathy requiring pharmacological treatment.
3. Age and BMI were also associated with painful neuropathy.

for painful diabetic neuropathy, 1000 (30.6%) had one of these diagnoses.

Townsend index scores ranged from −6 to +8, with higher scores relating to increased social disadvantage. When participants were categorised according to whether they received treatment for neuropathic pain or not, there were significant differences between the groups in Townsend index scores, with a greater proportion of those receiving treatment having a score of ≥1 (30.6% vs 22.8%; *chi*-squared=83.9; *P*<0.0001).

In univariate analyses, each unit increase in Townsend index score was associated with a 6% increased risk of having painful neuropathy requiring pharmacological treatment. *Figure 2* displays participants' probability of having neuropathic pain requiring treatment in relation to Townsend index score.

These findings were supported by multivariate analyses, in which, again, each unit increment in Townsend score was associated with a 6% increased likelihood of having painful neuropathy. In these analyses, the probability of having painful peripheral neuropathy requiring treatment increased by 5% for each 5-year increase in age, and by 3% for each unit increase in BMI. There was a 3% reduction in risk for each 5-unit increase in estimated glomerular filtration rate (indicating better renal function), and a 3% reduction for each 5-mmHg increase in systolic blood pressure. There was no relationship with HbA_{1c} or circulating cholesterol levels. Exclusion of the 1000 participants with depression or mixed anxiety/depressive disorder did not change the risk estimates in the multivariate model.

Discussion

We have found a significant independent association of social disadvantage with the risk of symptomatic diabetic peripheral neuropathy in people with type 2 diabetes. This was independent of glycaemic control, suggesting

Figure 2. Participants' likelihood of receiving treatment for painful diabetic neuropathy as a function of Townsend deprivation index score. The proportion of participants with each Townsend score are presented on the left y-axis (gold histogram), and the probability of being prescribed treatment is presented on the right y-axis (red line).

that lifestyle factors and societal disadvantage may play a role in the aetiology of neuropathic pain independent of their influence on metabolic control.

The results reflect our previous findings that a higher level of socioeconomic deprivation may independently predispose to severe neuropathic pain in people with type 1 diabetes (Anderson et al, 2014). At 21%, the overall prevalence of painful diabetic neuropathy in our cohort was comparable to that found in an earlier community-based study in northwest England (Tesfaye et al, 1996).

The existence of an inverse care law – in that people in greatest need of healthcare are the least likely to receive it – is important to consider in the context of our data. Healthcare providers' willingness and ability to provide comprehensive complication reviews for people with diabetes, and their knowledge of newer trials supporting the benefits of intensive management, are likely to be worse in deprived areas (Franks et al, 2003). In publicly funded healthcare systems such as the NHS, inequities like these can be addressed.

We also studied drug prescription patterns for painful neuropathy in our cohort. Amitriptyline was the most common agent prescribed to treat neuropathic pain. Current guidelines issued by NICE (2013) for the treatment of neuropathy in a non-specialist setting, usually primary care, recommend any one of amitriptyline, duloxetine, gabapentin or pregabalin as first-line therapy, with a choice of one of the remaining three agents in case of ineffectiveness or intolerance. Capsaicin cream is permitted for people with localised neuropathy who are intolerant to or wish to avoid oral medications. There was a high rate of tramadol prescribing outwith NICE guidance for long-term management of neuropathic pain.

Study limitations

There were a number of limitations to our study, mainly related to the fact that we relied on pseudo-anonymised clinical records from family practitioners. This was, therefore, not a systematic study in which all participants had an identical assessment. It is also possible that, in a small number of cases, the aetiology of the pain was neuropathy unrelated to diabetes. Furthermore, the study was retrospective in relation to collection of data.

Conclusion

In conclusion, a higher level of socioeconomic deprivation appears to predispose to severe neuropathic pain in people with type 2 diabetes. In a publicly funded healthcare system like the NHS, this would suggest a need for targeted allocation of healthcare resources in areas of relative disadvantage, as well as a focus on preventative strategies through healthcare education and focussed diabetes management. ■

Abbott CA, Malik RA, van Ross ER et al (2011) Prevalence and characteristics of painful diabetic neuropathy in a large community-based diabetic population in the U.K. *Diabetes Care* **34**: 2220–4

Anderson SG, Malipatil NS, Roberts H et al (2014) Socioeconomic deprivation independently predicts symptomatic painful diabetic neuropathy in type 1 diabetes. *Prim Care Diabetes* **8**: 65–9

Franks P, Fiscella K, Beckett L et al (2003) Effects of patient and physician practice socioeconomic status on the health care of privately insured managed care patients. *Med Care* **41**: 842–52

NICE (2013) *Neuropathic pain in adults: pharmacological management in non-specialist settings* (CG173). NICE, London. Available at: www.nice.org.uk/guidance/cg173 (accessed 27.10.16)

Pop-Busui R, Lu J, Lopes N, Jones TL; BARI 2D Investigators (2009) Prevalence of diabetic peripheral neuropathy and relation to glycemic control therapies at baseline in the BARI 2D cohort. *J Peripher Nerv Syst* **14**: 1–13

Tesfaye S, Stevens LK, Stephenson JM et al (1996) Prevalence of diabetic peripheral neuropathy and its relation to glycaemic control and potential risk factors: the EURODIAB IDDM Complications Study. *Diabetologia* **39**: 1377–84

Townsend P, Phillimore P, Beattie A (1987) *Health and Deprivation: Inequality and the North*. Croom Helm Ltd, Kent

Young MJ, Boulton AJ, MacLeod AF et al (1993) A multicentre study of the prevalence of diabetic peripheral neuropathy in the United Kingdom hospital clinic population. *Diabetologia* **36**: 150–4

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