


A Data-Driven Approach At Characterizing Heterogeneity In Neuropathy Assessments

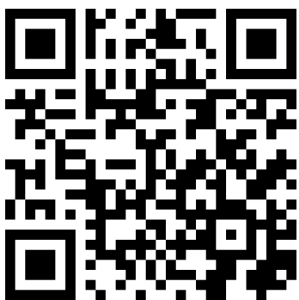
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- **Aims:** Identify potential clusters/groupings within neuropathy assessment items and responses that may characterize neuropathy in those with type 2 diabetes, using data-driven methods.
- **Study sample:** 10-year exam of ADDITION-DK.
- **Assessment:** Diabetic neuropathy assessed by several clinical scoring systems (TCSS, mTCSS, UENS, MNSI, DN4), Sural nerve conduction studies, and heart rate variability measurements.
- **Analysis:** Cross-sectional. Hierarchical clustering to find clusters between individuals' responses. Factor analysis of mixed data to find groupings in assessment items. Used data on complete cases of all nerve assessments (n=183).
- **Results:** For 3 fixed clusters (Fig. A): 1 was dominated by “no”, “pass”, or “decreased” responses; 2 was dominated by responses for reduced sensation and greater pain in feet; 3 was dominated by responses for reduced touch, temperature, and vibration sensation and more pain up to the ankle. Factor analysis of first 3 components (11.1%, 6.5%, 5.3% mean explained variances, respectively) showed top contributor assessment items grouped into touch sensation, feeling of pain in feet, and ankle reflexes (Fig. B).
- *More detail on methods and results found in online resource (link below).*

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Individuals can be classified into clusters by their specific responses to the neuropathy assessments and only a few assessment items may be needed to identify neuropathy cases. Using data-driven clustering and feature extraction algorithms may help arrive at a consensus on assessing neuropathy.

A Most common and likely responses to all neuropathy assessment items within each data-derived cluster group

	Cluster: 1	Cluster: 2	Cluster: 3
DN4	Pain caused or increased by brushing?: Pass Pain in area may reveal hypoesthesia to prick?: Pass Pain in area may reveal hypoesthesia to touch?: Pass	Is pain associated with itching?: 2 Is pain associated with numbness?: No Is pain associated with pins & needles?: No Is pain associated with tingling?: No Pain feels like burning?: No Pain feels like electric shocks?: No Pain feels like painful cold?: No Do you suffer from pain in your feet?: Yes Is pain associated with pins & needles?: Yes Pain feels like electric shocks?: Yes Pain feels like painful cold?: Yes Pain in area may reveal hypoesthesia to prick?: Yes Pain in area may reveal hypoesthesia to touch?: Yes	Is pain associated with itching?: 1 Pain feels like painful cold?: No Is pain associated with numbness?: Yes Is pain associated with pins & needles?: Yes Is pain associated with tingling?: Yes Pain feels like burning?: Yes Pain feels like electric shocks?: Yes
MNSI	Are you able to sense your feet when you walk?: No In tub or shower, can tell hot from cold water?: No Ankle reflexes: Present Ankle reflexes: Present with reinforcement	Have you ever had an open sore on your foot?: Yes	Monofilament great toe: Absent(0) In tub or shower, can tell hot from cold water?: No Are your feet too sensitive to touch?: Yes Does it hurt when bed covers touch your skin?: Yes doctor ever told you that you have diabetic neuropathy?: Yes
Monofilament	Light touch under foot, point 2: Abnormal(≤1/3)		Light touch under foot, point 2: Abnormal(≤1/3)
mTCSS	Position sensation: Decreased at ankle or absent on toes o symptoms?: Yes, but not interferes in well-being/daily living Ataxia?: Yes, interferes in well-being, not daily living	Foot pain?: Yes Foot pain?: Yes, but not interferes in well-being/daily living Ataxia?: Yes, interferes in well-being & daily living Foot pain?: Yes, interferes in well-being & daily living Numbness?: Yes, interferes in well-being & daily living Weakness?: Yes, interferes in well-being & daily living	Pin prick: Decreased at ankle or absent on toes Foot pain?: Yes Foot pain?: Yes, but not interferes in well-being/daily living Weakness?: Yes, but not interferes in well-being/daily living
TCSS	Position sensation for great toe: Abnormal Ankle reflex: Decreased(present by reinforcement) Ankle reflex: Normal Knee reflex: Normal	Foot pain?: Yes	Light touch (monofilament) for foot: Abnormal(≤4/8) Pin prick (neurotip) for foot: Abnormal(≤4/8) Foot pain?: Yes
UENS	Neurotip section 1: Absent Position sense great toe: Absent Ankle reflex: Decreased Ankle reflex: Normal	Extension great toe: Decreased Neurotip section 5: Decreased Neurotip section 6: Decreased Allodynia leg: In toes/foot	Neurotip section 1: Absent

B Neuropathy assessment items that are most frequently the top contributors to the three data-derived factor analysis components

	Component: 1	Component: 2	Component: 3
DN4	Do you suffer from pain in your feet? Is pain associated with itching? Is pain associated with numbness? Is pain associated with pins & needles? Is pain associated with tingling? Pain feels like burning? Pain feels like electric shocks? Pain feels like painful cold?	Do you suffer from pain in your feet? Is pain associated with itching? Is pain associated with numbness? Is pain associated with pins & needles? Is pain associated with tingling? Pain feels like burning? Pain feels like electric shocks? Pain feels like painful cold?	
MNSI			Ankle reflexes Vibration perception at great toe
mTCSS	Foot pain?		
TCSS	Foot pain?	Light touch (monofilament) for foot	Ankle reflex Knee reflex
UENS			Ankle reflex Neurotip section 1 Vibration on great toe