Risk Factors for Lower Extremity Ulcer in the Morbidly Obese Diabetics

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Introduction

- ~50% of veterans with diabetes were obese (BMI ≥30) and ~24% morbidly obese (BMI ≥35) in 2003
- A lifetime risk of having LEU is 15% with a prevalence of ~10%
- > 18,000 veterans were hospitalized with LEU in 1998
  - 5,300 had LE amputation
  - 80% of the amputation may have been due to LEU

Lower Extremity Ulcer

- LEU frequently occurred in the foot and ankle
- Its complications include infection, osteomyelitis, gangrene, amputation and disability

Objective

- To estimate the prevalence of LEU in the VA diabetic population
- To assess whether obesity is associated with increased LEU prevalence
- To test disease-disease interactions among obesity, PN, and PVD

Methods

- Data Sources
  - VHA Medical SAS Inpatient and Outpatient Datasets of all VHA hospitals and clinics in the US
  - VA Corporate Data Warehouse Vitals Data (Height and Weight)
  - VHA Decision Support System Lab Results Data (HbA1c)
  - VHA Decision Support System Pharmacy Data (Diabetes Medication)

Methods

- Study Sample
  - VHA users with diabetes in FY2003
  - VHA users with at least one valid pair of height and weight
    - Height: 122 – 213 cm
    - Weight: 34 – 227 kg

Method-Definition

- Lower-Extremity Ulcer was defined by the presence of the following ICD-9-CM codes
  - 707.1, 707.9, or 250.8 (chronic non-healing ulcers)
  - 681.10, 681.11, 682.6, or 682.7 (cellulitis, abscess, or infected ulcers)
  - 729.4, 730.x, or 731.x (osteomyelitis)
  - 785.4, 040.0, or 440.24 (gangrene)
  - 768 (stump infection)
  - 997.6 (complication from orthopedic procedure
  - 440.3, 996.62, 996.7, 996.74, or E868.2 (complication from vascular graft)
  - 707.0 (ulcer of the skin)
  - 707.13 (ulcer of the ankle)
  - 707.14 (ulcer of the heel or the midfoot)
  - 707.15 (ulcer of the toes).

Method-Definition

- Body mass index (BMI= kg/m^2) is the key covariate in the study
- Data Source: VHA Corporate Data Warehouse, 92% in the current study sample had ≥2 measurements.
- 64.7% of 561,963 diabetes patients in the sample had BMI
- 98% percent had BMI value between 20 and 50

Method-Risks

- **Covariates**
  - **Demographic characteristics: age , gender, race, marital status**
  - **Diabetes control (mean HbA1c level)**
  - **Diabetes duration (up to 6 years)**
  - **Peripheral neuropathy (PN)**
  - **Peripheral vascular disease (PVD)**
  - **Visual impairment**
  - **Osteoarthritis of the knee** and the ankles
  - **Charcot arthropathy**
  - **Histories of foot ulcer and amputation**

Method - Disease Groups

- **Disease-Disease Interaction**
  - **Mutually exclusive disease groups formed by PN and PVD**
  - **None, PN alone, PVD alone, and PN + PVD**
  - **BMI and BMI^2 were interacted with the disease group indicators to model BMI effect on LE ulcer rates for different groups separately**

Results

- 561,963 patients in the sample
- LEU prevalence in 2003 was 6.74%
- Higher crude rates for:
  - < 75 or ≥ 74 age group
  - Black and Hispanic (9.3%)
  - Diabetes ≥ 6 yrs (12.7%)
  - HbA1c > 9% (10.5%)
  - History of ulcer and amputation
- Lower crude rates for married individuals (3%)

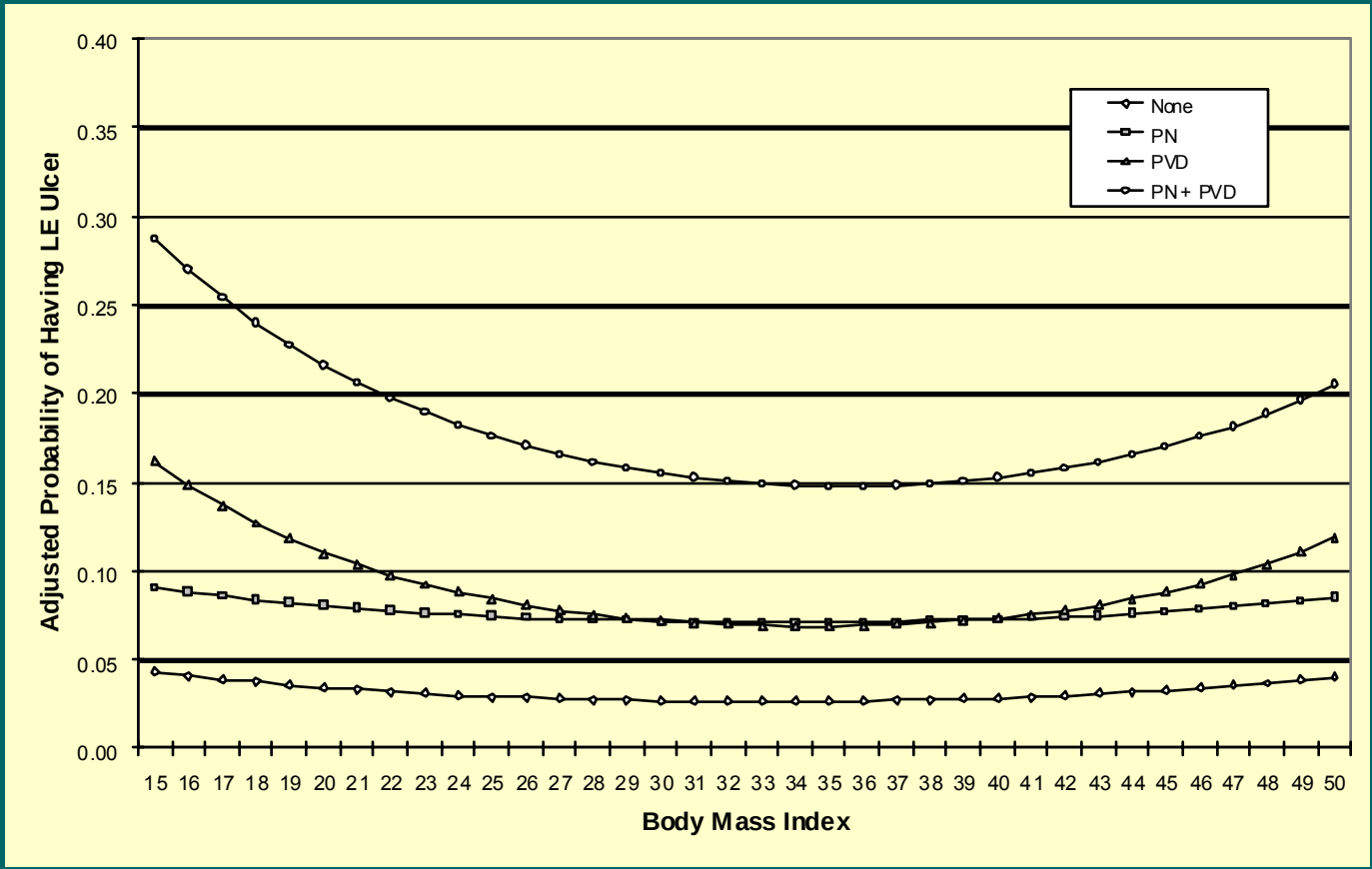
Results

- Crude LEU rates by disease group and BMI

BMI	% Sample	Prevalence Rates (%)				
		None	PN	PVD	PN + PVD	All
< 20	1.0	9.93	27.77	32.10	52.55	15.61
20 - 25	12.7	4.67	16.33	18.64	40.51	7.99
25 - 30	36.1	3.64	13.30	13.40	32.77	5.89
30 - 35	29.8	3.78	14.00	12.99	32.99	6.03
35 - 40	13.4	4.56	16.26	16.57	35.61	7.18
40 - 45	4.7	5.80	17.56	20.73	41.25	8.88
≥ 45	2.4	7.88	20.16	28.61	44.16	11.32
All	100.0	4.19	14.90	15.41	35.32	6.74
N	561,963	456,449	55,090	36,549	13,875	561,963

Results

- Adjusted prevalence rates by disease groups and BMI



Results - Summary

- BMI and LE ulcer prevalence – U-shaped association in all disease groups
- BMI effect is considerably different in different disease groups
- Strongest effects in PVD or PN+PVD groups
- Class II obesity (BMI 35 – 40) – Lowest prevalence in all disease groups
- Increasing BMI after 40 increases LEU risks
- Positive BMI and LEU risk association is found only for morbidly obese patients (BMI ≥ 35)

Conclusion

- First reported prevalence of LEU (6.74%) in a large population-based sample
- Age, race, marital status, BMI, PN, PVD,DM duration, DM control, Charcot arthropathy, history of LEU and amputation were risks significantly associated with LEU prevalence
- A U-shaped relationship between BMI and LEU prevalence in all disease groups
- Weight reduction can decrease LEU rates for those with BMI > 40 and will reduce the LEU rates most in PVD or PN+PVD groups

Limitation

- This sample may not represent all VHA patients with DM, some may have had treatment outside of the VHA
- Missing BMI data may be due to sicker and or immobile patients
- No clinical exam was performed

Recommendation

- Those vulnerable BMI groups should receive priority in clinical intervention to prevent and or promote healing of LEU
- Obese patients with DM >6 yrs, HbA1c >9% required special attention to prevent LEU
- Annual foot screenings for PVD and PN, including quarterly foot care, proper footwear assessments, when indicated
- Re-enforced LE skin care and self-management skill

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