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Utilization of Vascular Assessment Before Lower Extremity Amputation in Patients with Diabetic Foot Ulcers

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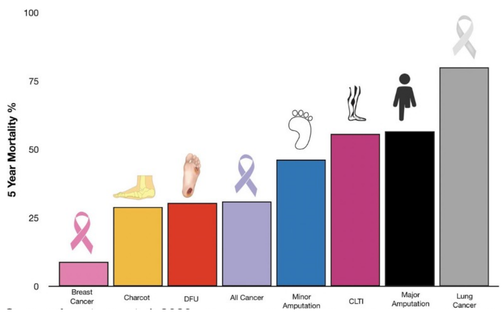
INTRODUCTION

Burden of DFU

- **Diabetic foot ulcers (DFU)** is a severe complication stemming from diabetic mellitus.[1]
- The U.S. annual incidence of 3-4% in the diagnosed and undiagnosed diabetes patients, 858,000 in total.[1]
- Without proper care, DFU can lead to severe infections that spread to soft tissue or bone that requires **lower extremity amputation (LEA)** that can lead to great morbidity and high mortality.[2]
- **Five-year mortality of DFU is comparable to cancer**.[2]



- The care of DFU and its associated adverse events especially LEA exerts a heavy financial toll on society, representing more than **$79 million direct medical costs** in the U.S. per year.

Peripheral Diagnostic Vascular Testing

- LEAs are potentially preventable by early detection of risk and subsequent patient-centered care such as revascularization.
- Despite the current guidelines from **International Working Group on Diabetic Foot (IWGDF) 2019**, there is still an underutilization of diagnostic vascular testing

→ **Missed opportunities** for timely evaluation of DFU risk and appropriate treatment to prevent aggravated progression that leads to major LEA and the greater downstream healthcare resources use.

OBJECTIVES

- To explore the variability in utilization of 12-month pre-LEA diagnostic vascular testing among DFU patients.
- To evaluate the social determinants of health (SDOH) predicting whether a patient receives diagnostic vascular testing.

METHODS AND MATERIALS

Study design: Retrospective cohort study

Data: OPTUM's de-identified Clinformatics Data Mart (CDM) Database linked to Socio-economic Status (SES) file (2010-2021).

Key explanatory variables

- Demographics (age, gender, race/ethnicity, region of care)
- Insurance enrollment status (Medicare Advantage, insurance type)
- DFU severity [gangrene > osteomyelitis > early stage (foot ulcer > cellulitis/abscess of foot > cellulitis/abscess of toe > paronychia)]
- Comorbidities
- Socio-economic status (education, dual-eligibility, low-income subsidy, federal poverty status, household income level)

Inclusion criteria:

(1) Identify patients with at least 1 inpatient/SNF/HH diagnosis or 2 outpatient diagnoses for diabetes in combination with at least 1 diagnosis of lower extremity ulcerations afterwards.

(2) Select patients who received minor LEA (above the ankle) and/or major LEA (toe/foot; below the ankle) after confirmed DFU diagnosis. The INDEX DATE was registered as the date of the earliest LEA procedure.

(3) Include patients who had continuous enrollment for at least 24 months prior to the index date.

Exclusion criteria:

(1) Exclude patients who had any form of LEA before the confirmed DFU diagnosis.

(2) Exclude patients aged < 18.

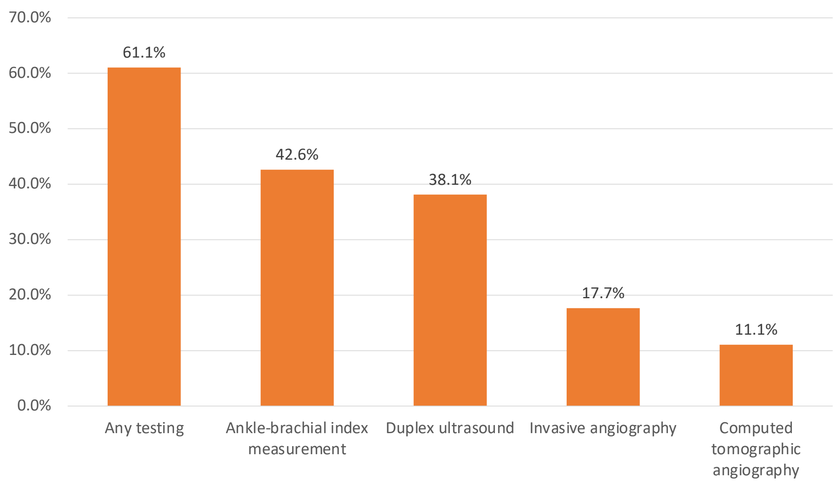
Statistical methods

- Descriptive statistics comparing patients' baseline characteristics by receipt of vascular testing or not.
- **Temporal trends** (quarterly) of the utilization of each pre-amputation vascular testing procedure will be evaluated and visualized.
- **A multivariate logistic regressions** to evaluate the baseline factors associated with the receipt of pre-LEA vascular testing.

RESTULS

Patient characteristics

- A total of 33,295 DFU patients sufficed the selection criteria for inclusion.
- The mean age of patients who received any pre-LEA vascular testing is 70.5 as opposed to the other cohort 66.6 years (p<0.001).
- More in those who received vascular testing were enrolled in Medicare advantage plans (81.4% vs 68.8%, p<0.001)
- The prevalence of comorbidities is higher among patients who received vascular testing, especially congestive heart failure, end-stage renal disease, stroke, etc)



Vascular testing within 12 months before index amputation

Utilization of vascular testing

- 61.1% of patients received vascular testing within 12 months before the index date.
- Ankle-brachial index (ABI) measurement, followed by duplex ultrasound, is the most commonly adapted procedure.

RESULTS

Logistic regression of receipt of pre-LEA vascular testing

- Older patients are more likely to get any pre-LEA vascular testing (p<0.001).
- Having baseline comorbidities is significantly associated with greater probability of receiving pre-LEA vascular testing, especially stroke, end-stage kidney disease, and congestive heart failure (p<0.001).
- The severity of DFU presentation is a significant predictor of receipt of vascular testing. The likelihood would increase threefold for patients with gangrene as opposed to those with early stage DFU (OR=3.53, p<0.001).
- Compared with patients in Southeast region, the ones residing in Southwest region (OR=1.2) are more likely to receive vascular testing in the year before LEA (OR=1.2, p<0.001); the ones residing in the West region have smaller probability of getting a vascular testing (OR=0.8, p<0.001).

CONCLUSIONS

- Despite the IWGDF 2019 guidelines recommendations, there are still gap in DFU patients' access to vascular assessment.
- Great variation across geographic region in the probability of receiving vascular testing in the 1 year before LEA among DFU patients.
- In addition, patients with underlying comorbidities have greater probability of being vascular assessed before LEA.
- Severe presentation of DFU, especially gangrene, is also associated with greater probability of receiving pre-LEA vascular testing.
- Due to lack of clinical granularity data, we were unable to capture the specific measures of the wound presentation such as the Wound, Ischemia, foot Infection (WIfI) score.