Norfolk and Norwich University Hospitals NHS
NHS Foundation Trust

Glycaemic Variability As Measured By The Magnitude Of Change Of Visit To Visit HbA1c Concentrations Over The 5 Years Prior To Presentation, Is Significantly Associated With Rate Of Wound Healing In The Diabetic Foot

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Background

- Recent work has suggested that glycaemic variability – the visit-to-visit variation in HbA1c – plays a role in the development of micro and macrovascular disease in patients with diabetes[1-4]
- However, whether HbA1c variability is a factor determining wound healing in diabetes related foot ulcers remains unknown

1. Virk SA, et al *J.Clin.Endocrinol.Metab.* 2016;101:3257-3263
2. Luk AO et al *Diabetes Metab.Res.Rev.* 2013;29:384-390
3. Gorst C et al *Diabetes Care* 2015;38:2354-2369
4. Dorajoo SR et al *Diab.Res.Clin.Pract.* 2017:128:32-39

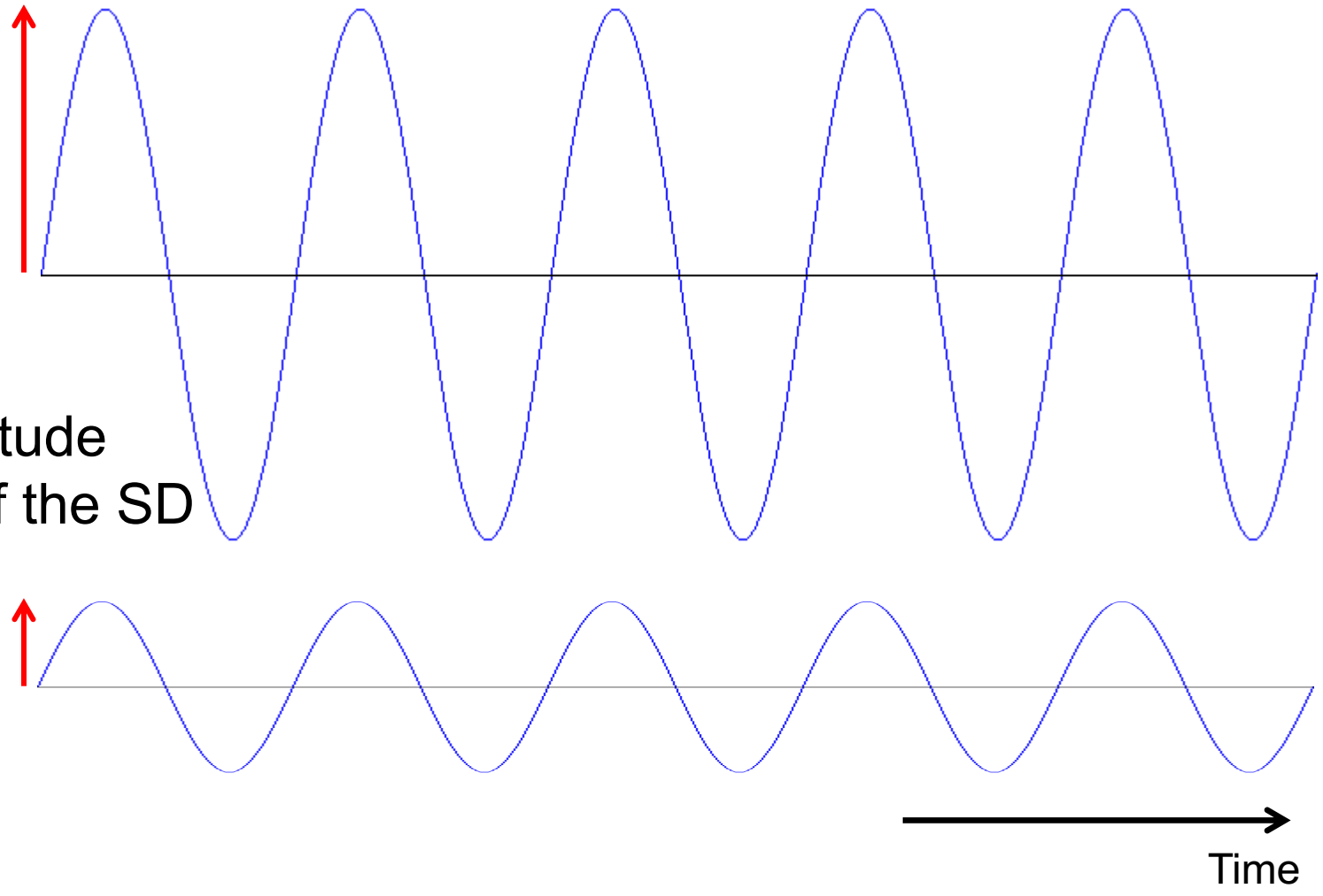
Aim

- To determine whether HbA1c variability is associated with wound healing time in patients presenting to our multidisciplinary specialist foot clinic

Methods

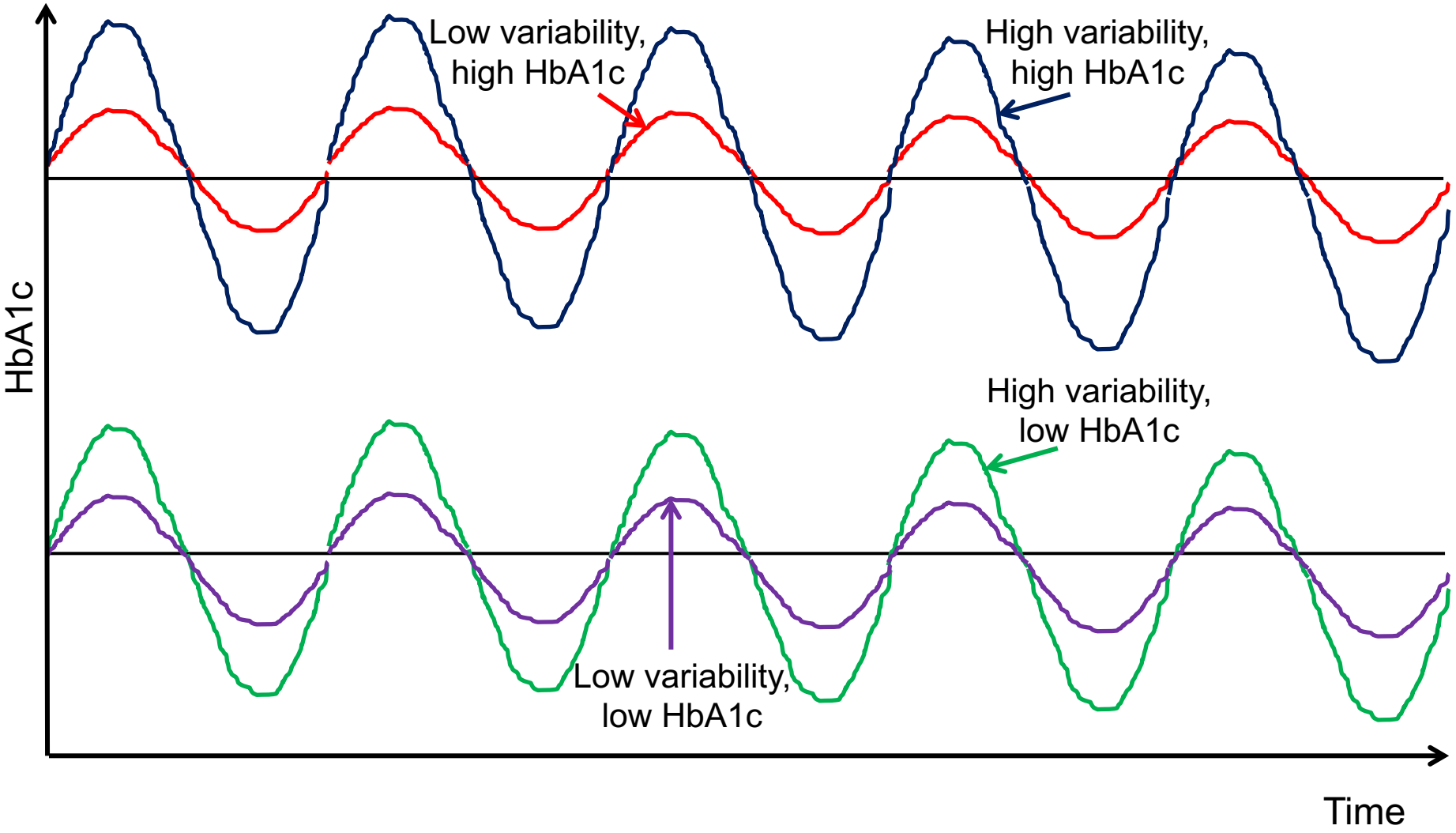
- A retrospective analysis
- Patients presenting between July 2013 and March 2015
- At least 3 HbA1c measurements 5 years prior to first presentation with a foot ulcer
- Must have at least 2 follow-up reviews within 1 year after first presentation were included
- HbA1c variation was measured by the magnitude of Standard Deviation (SD)

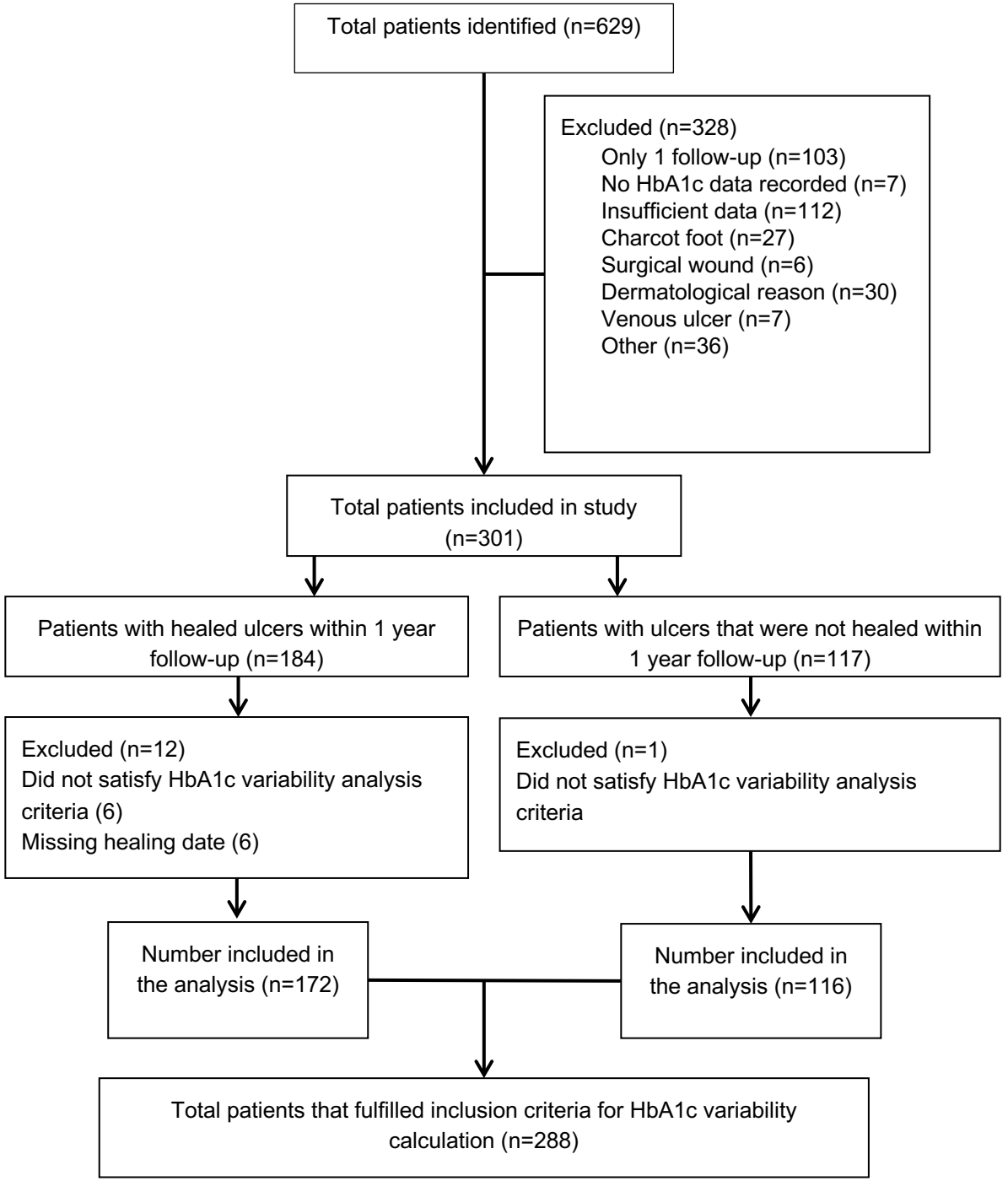
Variability



The magnitude variation of the SD

Analyses


Low variability, high HbA1c
High variability, high HbA1c
High variability, low HbA1c
Low variability, low HbA1c
HbA1c
Time


Total patients identified (n=629)
Excluded (n=328)
Only 1 follow-up (n=103)
No HbA1c data recorded (n=7)
Insufficient data (n=112)
Charcot foot (n=27)
Surgical wound (n=6)
Dermatological reason (n=30)
Venous ulcer (n=7)
Other (n=36)
Total patients included in study (n=301)
Patients with healed ulcers within 1 year follow-up (n=184)
Patients with ulcers that were not healed within 1 year follow-up (n=117)
Excluded (n=12)
Did not satisfy HbA1c variability analysis criteria (6)
Missing healing date (6)
Excluded (n=1)
Did not satisfy HbA1c variability analysis criteria
Number included in the analysis (n=172)
Number included in the analysis (n=116)
Total patients that fulfilled inclusion criteria for HbA1c variability calculation (n=288)

Results – Healing Times

- The overall geometric mean days to heal was 91.1 days (SD 80.8 to 102.7)
- Those with low HbA1c variability group healed faster than those with high HbA1c variability
  - 78.0 days (60.2 to 101.2) vs 126.9 days (102.0 to 158.0), ($p<0.032$)

Results

- Mean HbA1c had a more significant association with time to healing (p=0.007)
- Those with low HbA1c (<58mmol/mol) and low variability, healed faster than those with high HbA1c and high variability
  - 73.5 days (59.5 to 90.8) vs 111.0 days (92.0 to134.0), (p=0.007)

Results - Other Factors (1)

- Ulcer healing was significantly better in those with longer duration of DM (p=0.028)
  - The odds of healing for DM duration of 8-15 years was 2.72 (95 CI 1.33 to 5.58) compared to DM <8 years
- Ulcer grade [Texas] (p<0.0001)
- Number of pulses (p<0.0001)

Results - Other Factors (2)

- ABPI (p=0.021)
- Past foot problems (p=0.045)
- T2DM patients on tablet or insulin OR for healing 2.6 (95% CI: 1.35 to 4.94) compared to patients with T1DM or diet controlled T2DM

Conclusions

- Our novel data has shown that wound healing times in diabetes related foot ulcers is significantly associated with HbA1c variability
- Lower HbA1c variability is associated with shorter time to heal
- These data confirm the importance of maintaining steady, tight glycaemic control, but also emphasise that large variations in HbA1c over time lead to longer healing times

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