Diabetes care & risk of kidney disease in Medicare elderly patients with diabetes: an instrumental variable analysis

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Introduction

Background

• In patients age 25-65 with type 2 diabetes (DM), increased glycemic control has been shown to reduce the risk of renal failure by 27%, of myocardial infarction by 16%, and of microvascular complication by 25%.

• In patients age 65+ with type 1 DM, increased glycemic control also reduces the risk of microalbuminuria by 39%, of albuminuria by 54%, and of macrovascular disease by 41%.

• American Diabetes Association (ADA) standards for diabetes care include at least two HbA1C tests a year.

Objective

• To examine the effect of HbA1c testing as a surrogate for glycemic control on the risk of chronic kidney disease (CKD) in DM patients older than 65.

Hypothesis

• An increased HbA1c test rate due to access to a DEP was associated with a reduction of CKD risk. A one percent increase in the HbA1c test rate caused a 6.79% decrease in CKD risk in the four-year follow up. This effect is attributable to the subgroup who received an HbA1c test due to a DEP.

Methods

• Population and data sources

  - 1998-99 Medicare patients with newly reported DM, age 65+, non-HMO, non-ESRD, part A and B eligible, w/o CVD prior to 1998, and alive at least 2 yrs after reported DM
  - 5% Medicare claims data
  - Study design
    - Two-year entry period with baseline data and HbA1c test (CPT code 80036) collected in the 2 years
    - Four-year follow-up with CKD complication and death data
  - Analytical model – instrumental variable (IV) analysis
    - IV: ADA Diabetes Education Programs (DEP) – to account for selection bias in observational study
  - Stage 1: Logistic regression
    - HbA1c: predicted HbA1c test rate from stage 1
  - Stage 2: Cox regression
    - CKD: β0 + β1*X + β2*HbA1c + μ
    - X: individual, social & healthcare variables
    - HbA1c: predicted HbA1c test rate from stage 1

Results

• Overall characteristics: among 13,282 DM patients:
  - Mean age: 72.64 ± 5.63
  - Male: 39.5%
  - Female: 60.5%
  - White, 86.4%; black, 8.6%
  - Hospitalization^ 3.3 ± 1.5 <0.0001
  - COPD* (%) 14.6 ± 10.8 <0.0001
  - Hypertension (%) 1.47 ± 1.29 ± 1.67 <0.0001
  - Liver disease (%) 1.81 ± 1.25 ± 2.61 <0.0016
  - Black (vs. white) 1.26 ± 1.04 ± 1.52 <0.0169
  - Other race (vs. white) 1.02 ± 0.79 ± 1.33 <0.8561
  - Income $28,449 < $32,769 1.10 ± 0.85 ± 1.41 <0.4536
  - Income $37,655 < $43,198 1.19 ± 0.94 ± 1.50 <0.1445
  - In patients age 25-65 with type 2 diabetes (DM), increased glycemic control has been shown to reduce the risk of renal failure by 27%, of myocardial infarction by 16%, and of microvascular complication by 25%.

• Glycemic control vs. standard care

  - Mean Follow-up after reported DM: 3.2 yrs
  - Validation of the IV
    - Evidence of selection bias (Table 1)
    - IV assumption 1 – IV affects HbA1c testing rate
    - F Value from stage 1: 10.31
    - IV assumption 2 – IV is uncorrelated with baseline characteristics and health status, therefore no direct effect on outcome (Table 2)
    - Effect of HbA1c testing on the risk of CKD from IV analysis and comparing result from UKPDS and DCCT (Table 3)

Conclusions

• Among 13,282 Medicare elderly DM patients, HbA1c test rates were 68.82% and 72.01% in the first 2 years, and rates of CKD were 6.57% and 7.92% in the third to sixth years of DM for patients outside and within an ADA Diabetes Education Program (DEP), respectively.

• An increased HbA1c test rate due to access to a DEP was associated with a reduction of CKD risk. A one percent increase in the HbA1c test rate caused a 6.79% decrease in CKD risk in the four-year follow up. This effect is attributable to the subgroup who received an HbA1c test due to a DEP.

• It is verified that this result was corrected for selection bias in the observational study due to two facts: this finding is consistent with DCCT and UKPDS findings, and is more preferable than the naive estimate (Table 4).

• Healthcare system characteristics play an important role in implementing the standards of diabetes care and affecting diabetes-related outcomes such as CKD.

• This study implies that access to care measured by HbA1c testing may be an appropriate measure in determining the effect of care processes on patient outcomes if corrected for selection bias such as an IV analysis in observational study.