
# Estimated GFR in Diabetes

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# Introduction

- Diabetic nephropathy triad
  - Albuminuria rise
  - BP rise
  - GFR fall
- Abnormal serum creatinine
  - Relative late stage in natural history
- Strategies to identify individuals at risk
  - Dipstick proteinuria
  - Microalbuminuria
  - BP


# Introduction

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  - **Microalbuminuria**
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# MA based strategies - pitfalls

- Uncertain predictive value
  - 20-30% progression (cf. 85-100% in 1980's)
- Other causes of albuminuria
- Non-albuminuric renal impairment
  - Non-diabetic renal disease in diabetes
  - ≈ 25% proven DN & normoalbuminuria


# GFR

- True GFR measurements unsuitable for mass screening
- Estimated GFR (eGFR)
  - From serum creatinine, age, gender, ethnicity…
  - Reliable indicators of renal reserve
- Supported by organisations
  - National Kidney Foundation
  - Renal NSF
  - ADA
  - (DUK, ABCD)


# CKD staging

**Table 1—*Stages of CKD***

| Stage | Description | GFR (ml/min/1.73 m$^2$ body surface area) |
|---|---|---|
| 1 | Kidney damage with normal or increased GFR | ≥90 |
| 2 | Kidney damage with mildly decreased GFR | 60–89 |
| 3 | Moderately decreased GFR | 30–59 |
| 4 | Severely decreased GFR | 15–29 |
| 5 | Kidney failure | <15 or dialysis |


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eGFR equation – C&G or MDRD


# Aims

- To evaluate renal disease burden in diabetes using eGFR – either by C&G or MDRD estimate
- To study the clinical utility of eGFR (over and above current markers)


# Methods

- Study design
  - cross sectional from district diabetes register
- Study period
  - Jan 2002 to June 2003
- MA screening
  - spot morning urine ACR (3.5mg/mmol threshold)
- SPSS 11.5 for statistical analysis


# eGFR equations

- **MDRD**

  $186 \times [\text{Serum Cr } (\mu\text{mol/l})/88.4]^{-1.154} \times [\text{Age}]^{-0.203} \times [0.742 \text{ if female}] \times [1.210 \text{ if Black}]$

- **Cockcroft's and Gault's equation**

  $$\frac{(140 - \text{age in years}) \times \text{body weight (kg)} \times K}{\text{Serum creatinine } (\mu\text{mol/l})}$$

  K = 1.23 for men or 1.04 for women

  Correction for BSA of $1.73 m^2$

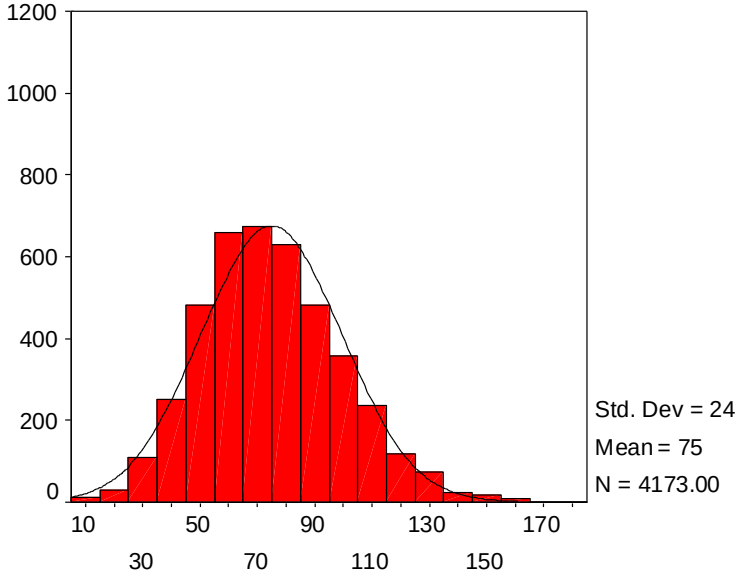

# Results

- Total N = 4548; N with eGFR = **4173**

| | |
|---|---|
| Age | 60±14y |
| Duration | 12±9y |
| BMI | 31±6Kg/m$^2$ |
| Males | 57% |
| Type 2 DM | 78% |
| Whites/Asians/AfroCarib | 68%/23%/9% |
| Serum Creatinine | 101±44µmol/l |
| Urine ACR | 1.75mg/mmol |

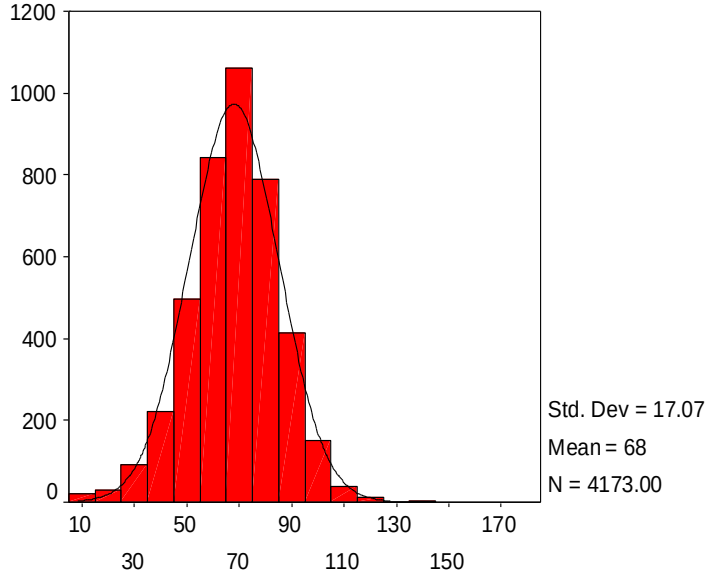
# Frequency distribution

Figure 1a



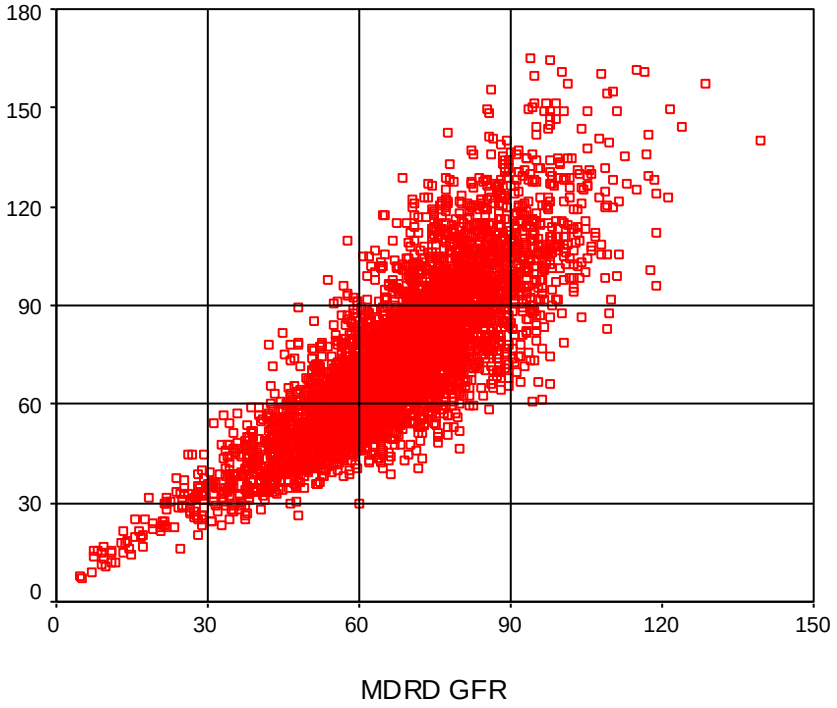

C&G eGFR

Figure 1b




MDRD eGFR

# C&G and MDRD correlation




| | >90, 60-90, 30-60 & <30 |
|---|---|
| C&G | 25%, 46%, 27% & 2% |
| MDRD | 9%, 62%, 27% & 2% |


# Concordance & Discordance

| | C&G >90 | C&G 90-60 | C&G 60-30 | C&G <30 | Total |
|---|---|---|---|---|---|
| MDRD >90 | **316 (87%)** | **49 (13%)** | 0 (0%) | 0 (0%) | 365 |
| MDRD 90-60 | **722 (28%)** | **1557 (61%)** | **295 (11%)** | 0 (0%) | 2574 |
| MDRD 60-30 | **10 (1%)** | **315 (28%)** | **795 (70%)** | **22 (2%)** | 1142 |
| MDRD <30 | 0 (0%) | 0 (0%) | **33 (36%)** | **59 (64%)** | 92 |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65% Green


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65% Green; 20% Amber


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65% Green; 20% Amber & 15% Red


# Renal risk markers in those with serious discordance

| | **C&G<60 MDRD>60 N=295** | **MDRD<60 C&G>60 N=325** |
|---|---|---|
| Abnormal serum Creatinine | 28 (10%) | 51 (16%) |
| Abnormal urine ACR | 90 (31%) | 112 (35%) |
| Abnormal creatinine or ACR | 107 (36%) | 136 (42%) |


# Study summary

- Renal disease burden was different depending on the eGFR equation used
- Full concordance observed in 65%
  - Serious discordance in 15%
- The majority with serious discordance had normal levels of other renal markers
  - Relying entirely on eGFR to flag their risk


# Discussion

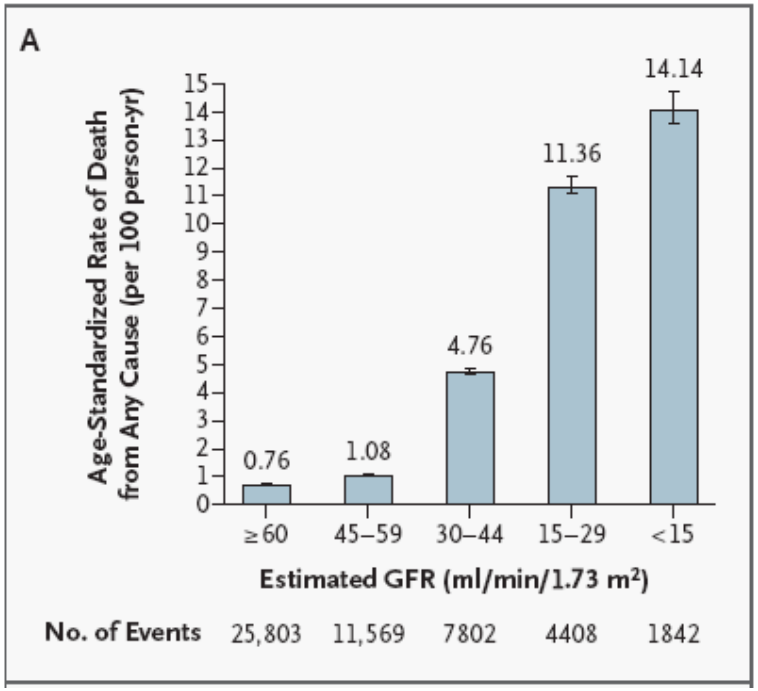
- **What does low eGFR really mean?**

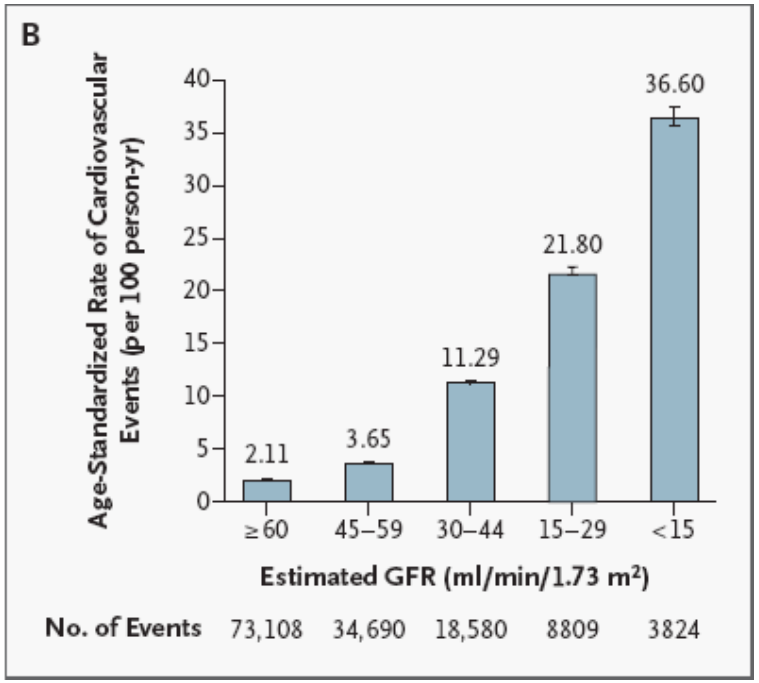

# eGFR, RRT & Mortality

| N=28,000 | Stage 2 | Stage 3 | Stage 4 |
|---|---|---|---|
| RRT (within 3yr) | 1.1% | 1.3% | 19.9% |
| Mortality | 19.5% | 24.3% | 45.7% |

Keith et al, Arch Intern Med 2004

# eGFR, mortality & CVS events




Go et al, NEJM, 2004


# Discussion – role of eGFR

- Renal progression indicator
- Predictor of mortality & CVS events
- Role in predicting safety of Metformin?
- Early and inexpensive identification of risk individuals

- No data to support intervention solely based on eGFR
- Lack of standardization of creatinine across labs
- Validation in diabetes lacking
- Exaggerates risk in the very old?


# Conclusion

- eGFR may have an additional role in renal and vascular risk prediction
- Need for a single equation of choice
  - Clarity
  - Uniformity of practice