Cardiovascular and renal replacement risks in patients with sub-optimally treated anemia of non–dialysis-dependent chronic kidney disease

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INTRODUCTION

- Patients with anemia* of non–dialysis-dependent chronic kidney disease (NDD-CKD) often do not receive any treatment for this condition[1,2]
  - Despite the burden of anemia of NDD-CKD, substantial treatment inertia is evident in the Middle East and Africa region[3]
- Patients with anemia of NDD-CKD also experience an increased incidence of renal events, adverse cardiovascular (CV) outcomes, and mortality, but it is unknown how these risks may vary following sub-optimal treatment[1,2]

Objective

- To estimate the risk of renal replacement (RR), CV and all-cause mortality (ACM), and major adverse cardiovascular events (MACE) in at-risk patients from Saudi Arabia, South Africa, and the United Arab Emirates (UAE)

METHODS

- The at-risk population for each country was defined as adult patients with sub-optimally treated anemia of NDD-CKD stage 3–5
- Sub-optimally treated anemia was defined as Hb<10.0 g/dL after treatment for Saudi Arabia and UAE, and untreated anemia for South Africa
- Endpoints were defined as:
  - RR: onset of dialysis/kidney transplant
  - CV+ACM: myocardial infarction (MI), unstable angina, coronary revascularization therapy, congestive cardiac failure, stroke, ACM
  - MACE: non-fatal MI/stroke/death due to CV event
- A quantitative model was used to compute the expected number of RR, CV+ACM, and MACE events in Saudi Arabia, South Africa, and UAE over 15 years:

Step 1: Identifying the at-risk population size in each country using input estimates from a targeted literature review, published sources, and data on file

Total population of country × % patients with NDD-CKD stage 3–5 × % patients with anemia of NDD-CKD stage 3–5 × % patients with anemia of NDD-CKD stage 3–5 who are sub-optimally treated

Step 2: Estimating the RR, CV+ACM, and MACE event risk for a representative patient in the at-risk population for each country using log-normal accelerated failure time models generated from:

- Survival models developed using data from the Salford Kidney Study (SKS)[4]
- Patient risk factors determined from literature[5–7], the SKS[4], and the SATISFY retrospective study[3]

Step 3: Calculating the number of expected events for the at-risk population in each country over 15 years

Estimated size of the at-risk population (Values from **Step 1**) × Estimated event risk for a representative patient (Values from **Step 2**)

Step 4: Identification of key parameters influencing event risk at 15 years via deterministic sensitivity analysis (DSA) and probabilistic sensitivity analysis (PSA)†

- DSA was conducted using prevalence percentages from the at-risk population size calculation and patient risk factors to examine univariate variability†
- PSA was conducted using Monte Carlo simulation to explore uncertainty on the prevalence percentages used in calculating the size of the at-risk population, risk equation parameters, and patient risk factors†

CONCLUSIONS

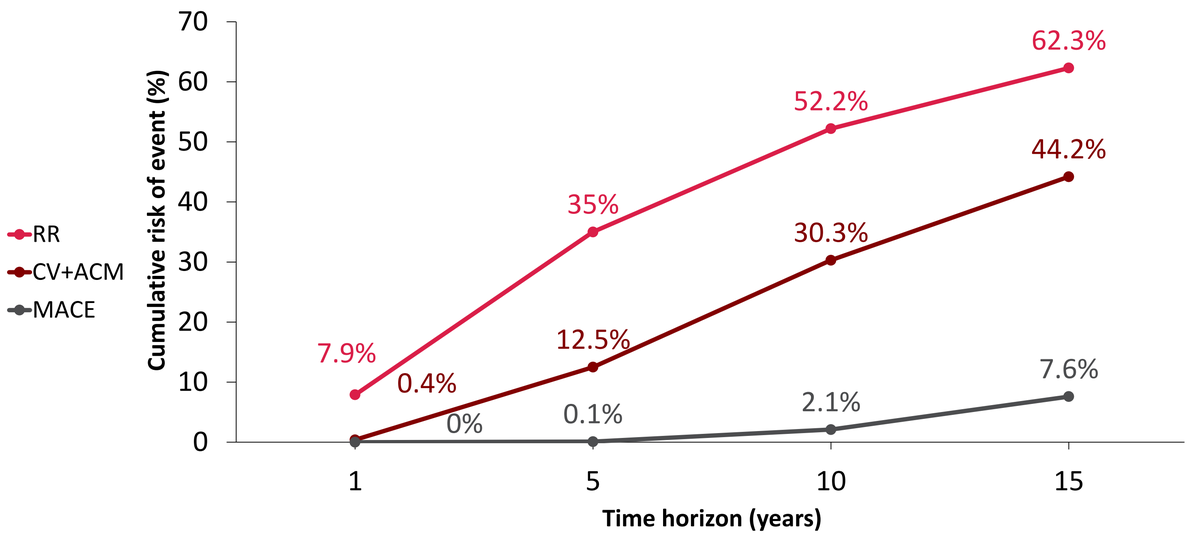
- The model projects a significant burden of illness associated with sub-optimally treated anemia of NDD-CKD in Saudi Arabia, South Africa, and the UAE over the next 15 years
  - These findings need to be validated with country-specific real-world data
- These preliminary estimates may help physicians and policymakers to understand the magnitude of their at-risk population and the urgency of improving care for these patients

RESULTS

- The size of the at-risk population was estimated to be 588,990, 502,245, and 176,374 patients in Saudi Arabia, South Africa, and UAE, respectively
- The number of expected events and estimated cumulative risk for RR, CV+ACM, and MACE at 1, 5, 10, and 15 years are presented for Saudi Arabia, South Africa, and UAE (**Figure 1**)
- A substantial number of at-risk patients are estimated to require RR within 15 years (Saudi Arabia [62.3%; n=366,937]; South Africa [40.9%; n=205,351]; UAE [62.3%; n=109,880])
- A notable number of patients are estimated to be at risk of CV+ACM events (Saudi Arabia [44.2%; n=260,166]; South Africa [38.6%; n=193,745]; UAE [44.2%; n=77,907]) and MACE (Saudi Arabia [7.6%; n=44,853]; South Africa [6.9%; n=34,904]; UAE [7.6%; n=13,431]) over the same timeframe

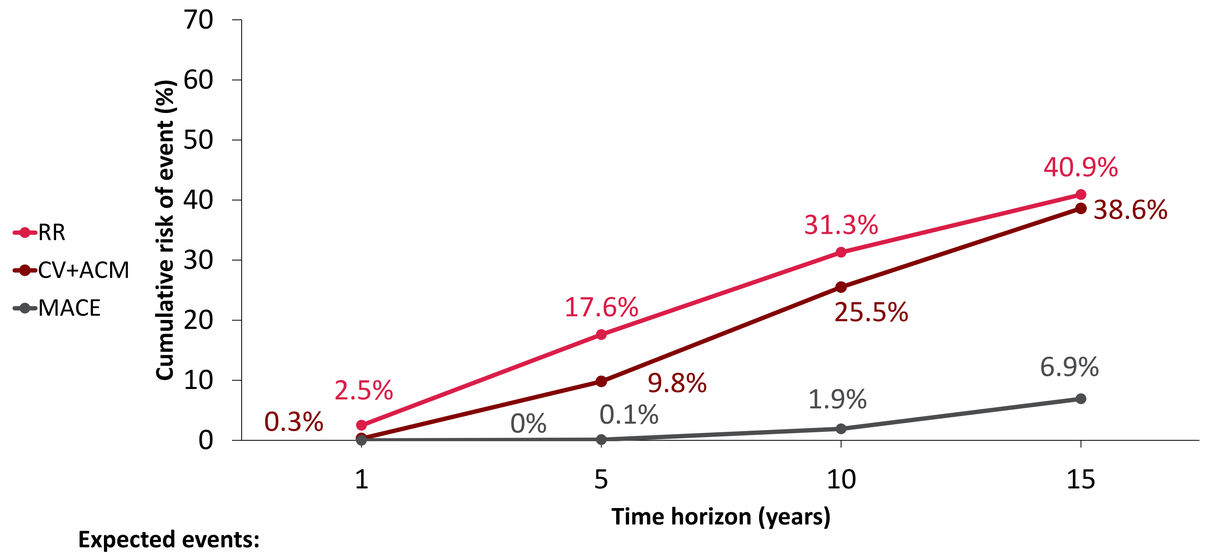
Figure 1. Estimated cumulative event (RR, CV+ACM, and MACE) risk and expected events over time in adult patients with sub-optimally treated anemia of NDD-CKD stage 3–5 by country

(A) Saudi Arabia



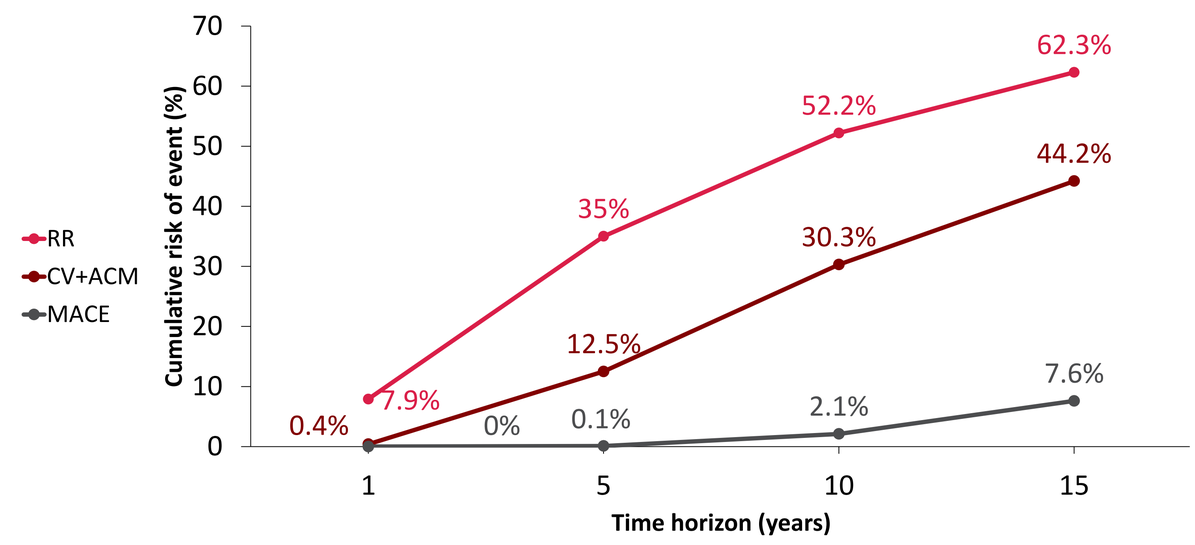
Expected events:				
RR	46,584	205,938	307,445	366,937
CV+ACM	2,613	73,814	178,320	260,166
MACE	0	662	12,452	44,853

(B) South Africa



Expected events:				
RR	12,702	88,476	156,970	205,351
CV+ACM	1,448	49,262	127,843	193,745
MACE	0	481	9,450	34,904

(C) UAE



Expected events:				
RR	13,950	61,668	92,065	109,880
CV+ACM	782	22,104	53,398	77,907
MACE	0	198	3,729	13,431

ACM, all-cause mortality; CV, cardiovascular; MACE, major adverse cardiovascular event; RR, renal replacement; UAE, United Arab Emirates

*Anemia was defined as hemoglobin: <13.0 g/dL in males, and <12.0 g/dL in females.[8] †Results for DSA and PSA are not shown here.

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