

# Vancomycin dosing calculator QA

## 1 Introduction

- Excel based calculator developed to help ensure correct dosing on vancomycin
- Based on BCUHB vancomycin chart
- Based on inputs (gender, height, age, weight, creatinine concentration, and date & time of initial dose), an initial dosing regimen is calculated (dose and timings for loading dose, maintenance doses 1-4, and suggested pre-level)
- Needed to QA the calculator

## 2 Method

- Simulate a random population ( $n = 100000$ ) to test a variety of inputs
- Create a second calculator in different software (R)
- Record outputs from both the Excel and R calculators
- Compare outputs, check for differences, identify source(s) of differences

## 3 Results

### 3.1 Simulated population

### 3.2 Do the two sets of results come from the same population?

Both calculators have used the same inputs.

### 3.3 Do the R and Excel outputs match?

- The calculators do not give the same results
- The differences range in both size and frequency
- id, crcl, and load\_dose are the same for both calculators for all cases.
- Differences in ibw and ddw are small and likely to be rounding differences due to the different software packages using a different number of decimal places in calculations.

Table 1: Minimum and maximum values in simulated population

statistic	height	age	weight	creat	datetime
Minimum	152.400	18	20.006	10.003	2020-01-01 12:22:00
Maximum	229.999	139	249.998	349.998	2030-01-01 11:26:00

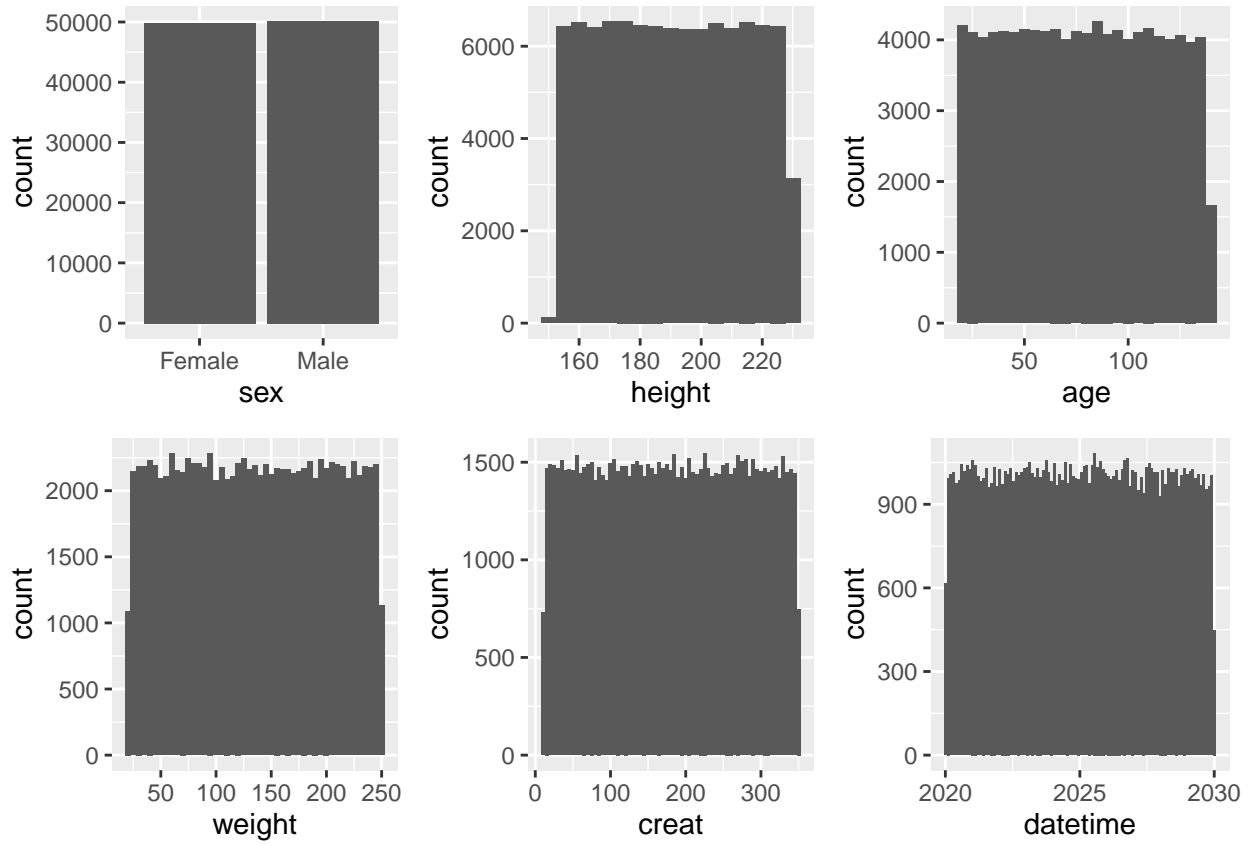


Figure 1: Distribution of simulated variables

Table 2: Percentage match for input data

data	id	sex	height	age	weight	creat	datetime
r_sim	100	100	100	100	100	100	100
excel_sim	100	100	100	100	100	100	100
r_excel	100	100	100	100	100	100	100

Table 3: Comparison of R and Excel results

Variable	Percentage	Count	Max abs diff
id	0.000	0	0.000
ibw	0.125	125	0.001
ddw	0.021	21	0.001
crcl	0.000	0	0.000
load_dose	0.000	0	0.000
dose1	1.714	1714	250.000
dose2	1.714	1714	250.000
dose3	1.714	1714	250.000
dose4	1.714	1714	250.000
dose1_time	1.133	1133	24.000
dose2_time	1.133	1133	48.000
dose3_time	1.133	1133	72.000
dose4_time	1.133	1133	96.000
pre_level_before	54.209	54209	2.000

- Results for doses 1-4 and their timing are different in less 2% of cases and the maximum difference is equivalent to a change of one step on the dosing ladder (i.e., 250mg and up to 24 hours in dose interval). These differences appear to be due to differences in “cut-points” for Table 2 - Maintenance dose from the Vancomycin Chart. The boundaries on the chart leave room for user choice (Table 4. For example, dosing ladder step 2 on the chart is based on creatinine clearance (CrCl) “90 to 110 mL/min” and step 3 is “75 to 89mL/min.” The user is then given the choice of assigning a patient with a CrCl of 89.5 to either step 2, by rounding to the nearest number, or step 3, by rounding down to the boundary
- The differences in **pre\_level\_before** are substantive. The BCUHB vancomycin chart states that the pre-dose level is needed before the third or fourth dose for steps 1-5 on the dosing ladder and before the second or third dose for steps 6-8 on the dosing ladder. For all steps on the dosing ladder, the chart states that this should ideally be done during working hours (0600-1759 based on communication with Calum).
  - Dosing ladder steps 1-5
    - \* In the R calculator, I assumed that the pre-dose level should be taken at the third dose and that if this fell outside of working hours, it should be changed to the fourth dose (i.e., 12 hours later).
    - \* In the Excel calculator, the pre-dose level is the third dose when that is in working hours, otherwise it is the fourth dose.
  - Dosing ladder steps 6-8
    - \* In the R calculator, I assumed that for steps 6-8 the pre-dose level should be taken at the second dose and that this should not change based on working hours, given that a change of 24 or 48 hours would still the same time of day, thus remaining outside of working hours.
    - \* In the Excel calculator, for steps 6-8 the pre-dose level is the third dose in all cases.

## 4 Modified R calculator

### 4.1 Modification 1 - CrCl boundary option 2

- As stated above, the dosing ladder boundaries based on creatinine clearance are unclear. 5 shows that the different interpretation of the boundaries (Option 2 in Table 4) resolves the discrepancies between

Table 4: Dosing ladder interpretations

Dosing ladder	CrCl	Option 1	Option 2
1	>110	>110	>110.5
2	90-110	110 $\geq x > 90$	110.5 $\geq x > 89.5$
3	75-89	90 $\geq x > 75$	89.5 $\geq x > 74.9$

Table 5: Comparison of R and Excel results - Modification 1

Variable	Percentage	Count	Max abs diff
dose1	0.000	0	0
dose2	0.000	0	0
dose3	0.000	0	0
dose4	0.000	0	0
dose1_time	0.000	0	0
dose2_time	0.000	0	0
dose3_time	0.000	0	0
dose4_time	0.000	0	0
pre_level_before	53.737	53737	1

the calculators for dosing. Please note, this also has a very small impact on the discrepancies between the pre-dose levels.

## 4.2 Modification 2 -

- Retaining modification 1 and applying a second modification to the pre-dose level

Table 6: Comparison of R and Excel results - Modification 2

Variable	Percentage	Count	Max abs diff
pre_level_before	0	0	0