

# 1 The Research of Carstensen et al

## 1.1 Bendix Carstensen's data sets

?describes the sampling method when discussing of a motivating example. Diabetes patients attending an outpatient clinic in Denmark have their  $HbA_{1c}$  levels routinely measured at every visit. Venous and Capillary blood samples were obtained from all patients appearing at the clinic over two days.

Samples were measured on four consecutive days on each machines, hence there are five analysis days. Carstensen notes that every machine was calibrated every day to the manufacturers guidelines.

## 1.2 Limits of agreement for Carstensen's data

? describes the calculation of the limits of agreement (with the inter-method bias implicit) for both data sets, based on his formulation;

$$\hat{\alpha}_1 - \hat{\alpha}_2 \pm 2\sqrt{2\hat{\tau}^2 + \hat{\sigma}_1^2 + \hat{\sigma}_2^2}.$$

For the 'Fat' data set, the inter-method bias is shown to be 0.045. The limits of agreement are  $(-0.23, 0.32)$

Carstensen demonstrates the use of the interaction term when computing the limits of agreement for the 'Oximetry' data set. When the interaction term is omitted, the limits of agreement are  $(-9.97, 14.81)$ . Carstensen advises the inclusion of the interaction term for linked replicates, and hence the limits of agreement are recomputed as  $(-12.18, 17.12)$ .

## 1.3 Using LME Models for Method Comparison

? formulates an LME model, both in the absence and the presence of an interaction term.? uses both to demonstrate the importance of using an interaction term. Failure to take the replication structure into account results in over-estimation of the limits

of agreement. For the Carstensen estimates below, an interaction term was included when computed.

## 1.4 Computing LoAs with LMEs

Carstensen presents a model where the variation between items for method  $m$  is captured by  $\sigma_m$  and the within item variation by  $\tau_m$ .

Further to his model, Carstensen computes the limits of agreement as

$$\hat{\alpha}_1 - \hat{\alpha}_2 \pm \sqrt{2\hat{\tau}^2 + \hat{\sigma}_1^2 + \hat{\sigma}_2^2}$$