Weqas | GLOBAL PROVIDER OF QUALITY IN DIAGNOSTIC MEDICINE

UKAS PROFICIENCY TESTING 4301 | UKAS CALIBRATION 4301

Tel: +44 (0) 2920 314750
E-mail: contact@weqas.com
Web: www.weqas.com

Weqas
Unit 6, Parc Tŷ Glas
Llanishen, Cardiff, UK
CF14 5DU

Analytical interferences due to challenging samples – a 12 year overview from the Weqas Serum Chemistry and Indices Programme

Author Names: M.A. Thomas, S. Jones, G. Davies
Weqas, Cardiff and Vale University Health Board, Cardiff, UK

Introduction

In 2010, the Weqas Serum Chemistry programme introduced challenging samples containing bilirubin, haemoglobin (Hb) or intralipid, distributed 4 times a year. The aims were to quantify the interference effects on methods / analysers used in routine assays, to determine the ability of the Haemolytic / Icteric / Lipaemic (HIL) tests to identify the interferant, and how these results are reported. This paper discusses the interference effects observed over the last 12 years.

Method

Human serum was spiked with bilirubin to provide a range of samples from 60-500 µmol/L, intralipid to a triglyceride of 3 to 12.6 mmol/L and lysed red blood cells to a Hb range of 0.4 to 3 g/L over the 12 year period. Two matched pools were distributed, one containing the interferant and the other the base serum every 3 months. Where possible the samples were also analysed using a reference measurement procedure, i.e. flame atomic emission / absorption spectrometry for sodium, potassium, calcium, magnesium and lithium, and GCMS for glucose, creatinine and urate. Participants were asked to test all 32 analytes and treat as patient samples.

The data over the last decade was reviewed and interforographs plotted for each analyte for the overall analyte, the method and the individual analysers. The interference effect was calculated as a percentage of the spiked / original results and compared with the concentration of the interferant.

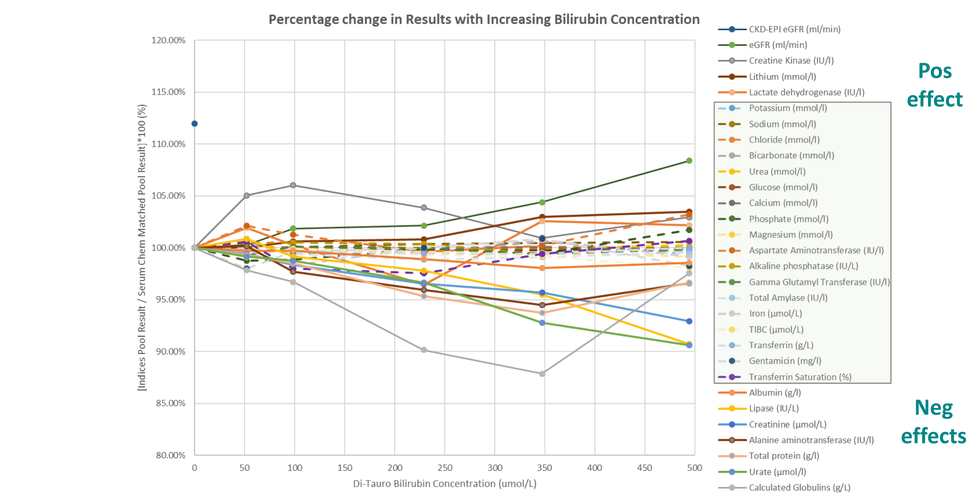
Review of Results 2010 to 2022

Figures 1a,b,c and d detail the effect of bilirubin on the common chemistry analytes, for all analytes (a), those where a deviation of ≥ 10% was observed (b), the effects on glucose and urate methods (c), and the impact on creatinine methods respectively (d). At a concentration of 500 µmol/l bilirubin, an all instrument negative bias of -10% was observed for lipase and urate, -8% for creatinine and -5% for total protein and Alanine Aminotransferase (ALT) respectively. A change of <5% was observed for the other analytes. However, a large variation was observed between instruments, with a -25% bias observed for the Beckman AU for Urate.

Figure 2a,b,c and d details the effect of haemolysis on the common chemistry analytes, for all analytes (a), those where little or no effect observed (b), and the effects on Lactate Dehydrogenase (LDH), potassium, creatinine and Alanine Aminotransferase (ALT) respectively (c,d). At a concentration > 0.4 g/L Hb, a positive bias due to cellular content release was observed for Iron, potassium, Aspartate Aminotransferase (AST) and phosphate with a positive analytical bias observed for Lipase, ALT, Creatine Kinase, Magnesium and LDH. A negative bias was observed for Gamma Glutamyl Transferase and Alkaline Phosphatase. A change of < 5% was observed for the other analytes.

For the lipaemic samples, figures 3a and b, show analytes with no affect (a) and small affect (b).

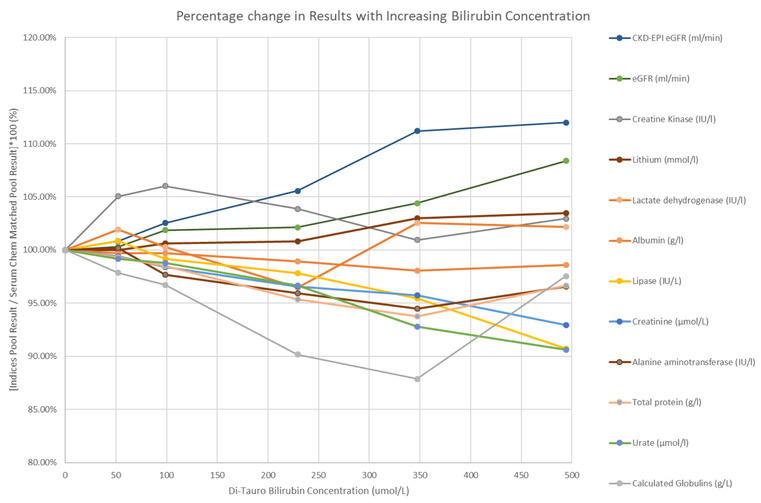
Icterus Interferograph – figure 1a - All analytes



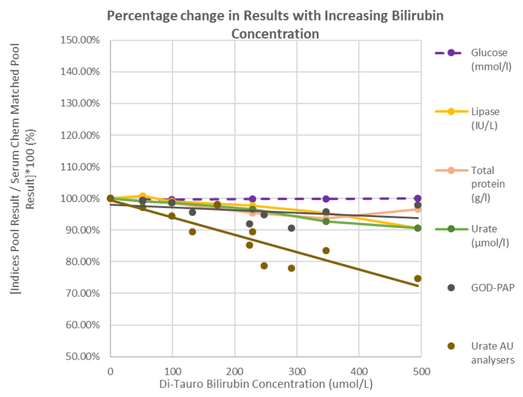
Pos effect

Neg effects

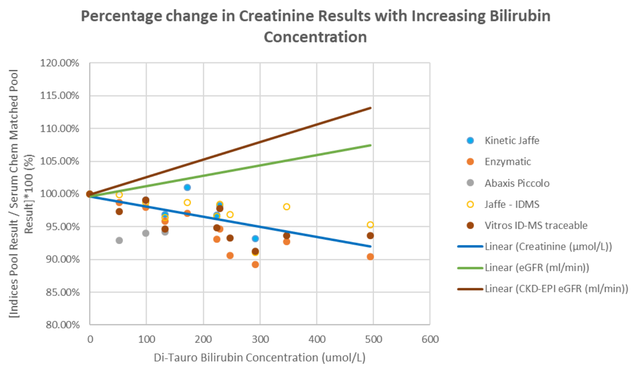
Icterus Interferograph – figure 1b – Analytes affected



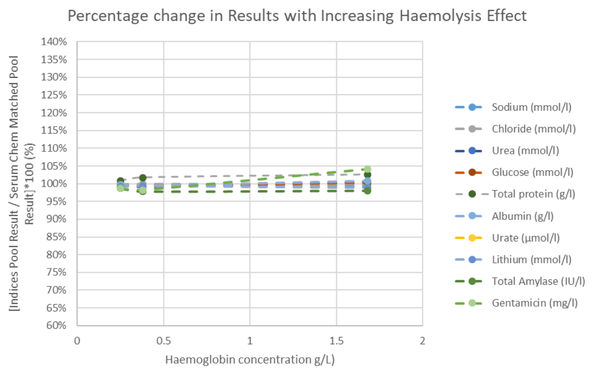
Icterus Interferograph –figure 1c – Effect on glucose & urate methods



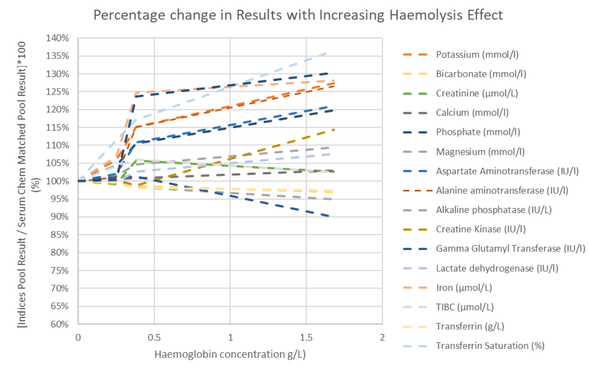
Icterus Interferograph –figure 1d – Effect on Creatinine methods



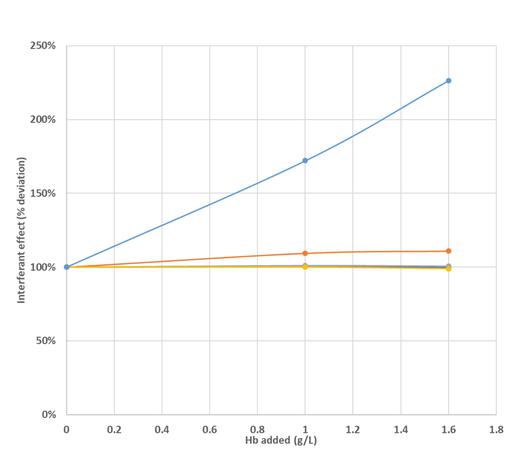
Haemolysis Interferograph – figure 2a Analytes where little or no effect observed



Haemolysis Interferograph – figure 2a All analytes

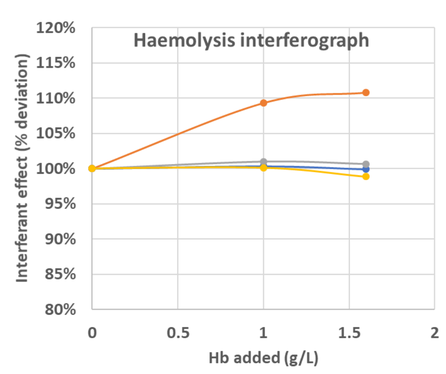


Haemolysis Interferograph – figure 2c,d Effects on LDH, Potassium, Creatinine and ALT



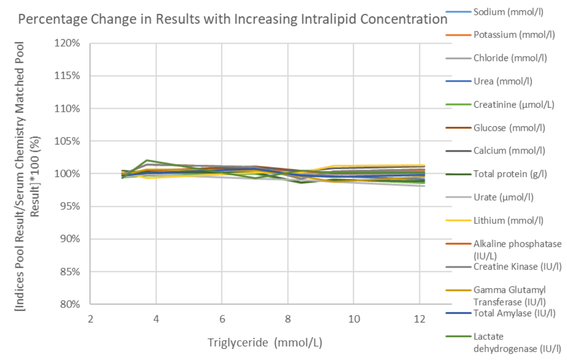
	Analytes affected by Interferant	
Pos (RBC)	Positive	Negative
Iron	Lipase, ALT	GGT
K	CK	ALP
AST, P	Mg, LDH	Transferrin
	Creat, TiBC	

Greatest influence

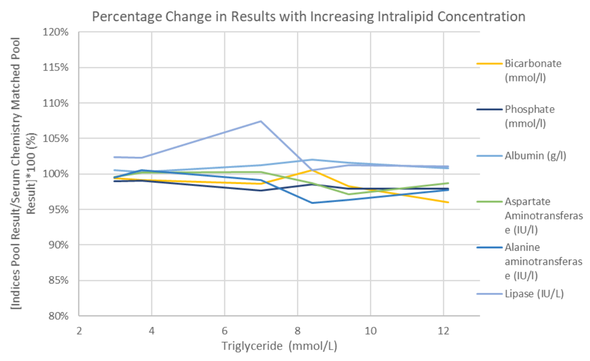


Lipaemia Interferograph – figures 3a, 3b

Analytes where no effect observed



Analytes where small affect was observed



Conclusion

Over this period most participants introduced the HIL test and as a result, the number reporting patient results with a HIL flag has decreased markedly. This has both positive and negative consequences, in that incorrect results are not released, however clinically important results are also missed. It is therefore important to quantify the effects of these interferences to make informed decision on “inaccurate” results based on the clinical utility of the test i.e. providing creatinine results with a known negative bias of 10% may be safer than no results.