**Appendix 3**

**Critique of Ophthalmological component**

Levin[1] has already provided a robust commentary on the SBU report from an ophthalmology perspective and identified the short sightedness of looking at generic retinal haemorrhages (RHs); ‘a concept which runs counter to the very fabric of ophthalmology and its tools which strive to distinguish and characterize specific types and patterns of hemorrhagic retinopathy’. We would reiterate that there are a number of inaccurate statements made in the introduction and discussion sections of the SBU report.

A number of recent systematic reviews of the retinal findings in abusive head trauma (AHT) provide high quality scientific evidence supporting the association of AHT in the presence of retinal injury.[2-4] Defining or ranking of the surety of abuse reduces the circular bias of these systematic reviews. In the absence of a medical cause, or an adequate explanation of retinal findings associated with head injury and other clinical findings, retinal haemorrhages raise a high probability of abuse[5], and it is the diagnosis of abusive injury that may save the child and other siblings from further injury.

The ~~authors~~ SBU report states that the presenting history of the triad’s components is often lethargy, apnoea and seizures, although these individual features have not been evaluated in their review. An individual patient analysis of 1053 children has shown that retinal haemorrhages in the presence of these component clinical features of subdural haemorrhage, apnoea and seizures has an odds ratio of > 85, and a positive predictive value of >85% for abusive injury.[6]

The aetiology of retinal haemorrhages in infancy are elucidated with a history, clinical examination and appropriate investigations.[7] RH associated with birth trauma are transient and more than 80% of the haemorrhages resolve within a few days of birth, these haemorrhages are usually superficial and more likely to be distributed at the posterior pole of the retina.[8 9] The retinal haemorrhages in medical conditions where there are overlapping features of abuse are rare and patterns of retinal findings differ.[10]

One of the main contenders in the differential diagnosis is witnessed accidental trauma. The authors have not attempted to discuss the important differences in the pattern of retinal findings in witnessed accidental trauma, and how this differs from the retinal findings of abusive injury. When retinal findings are described in terms of their laterality, location in the retinal layers, their distribution, their numbers and associated findings of retinal folds and haemorrhagic macular schisis, crucial differences arise between the two.[4] Previous commentary has alluded to this serious omission.[11]

The SBU review suggests retinal haemorrhages may be a sequel to a subdural haematomas and not caused by trauma. A population based study of subdural haematomas, where 82% were highly likely to be due to abusive head trauma, reported the absence of retinal findings in 22%, which suggests that retinal haemorrhages are not a necessary sequel to subdural haemorrhage.[12] The SBU review states that raised intracranial pressure leads to increased pressure in the central ‘optical’ vein leading to retinal congestion. There is no structure within the eye called the central optical vein, (this may be a translation issue) if the authors mean central retinal vein, then the pattern of a central retinal vein occlusion is distinctive, and can easily be distinguished from retinal findings in abusive head trauma.

The standard method of retinal examination in infants is indirect ophthalmoscopy with a condensing lens, and not fundoscopy (fundoscopy is examination of the fundus of the eye with any method) as mentioned in the SBU review. This demonstrates **no ophthalmology consultation** was made in conducting this review. The referencing of the review is inaccurate, reference 56 on page 14 of the report is on birth haemorrhages, and not the article relating to Magnetic Resonance Imaging demonstration of retinal findings. The authors state that retinal haemorrhages are open to subjective interpretation. However a previous report has shown that retinal findings recorded with the retcam **can** be objectively recorded using validated charts, with high inter and intra observer interclass correlation coefficients.[13]

References

1. Levin AV. The SBU report: a different view. *Acta Paediatr* 2017;106(7):1037-39. doi: 10.1111/apa.13834 [published Online First: 2017/03/17]

2. Bhardwaj G, Chowdhury V, Jacobs MB, et al. A systematic review of the diagnostic accuracy of ocular signs in pediatric abusive head trauma. *Ophthalmology* 2010;117(5):983-92 e17. doi: 10.1016/j.ophtha.2009.09.040 [published Online First: 2010/03/30]

3. Bhardwaj G, Jacobs MB, Martin FJ, et al. Photographic assessment of retinal hemorrhages in infant head injury: the Childhood Hemorrhagic Retinopathy Study. *J AAPOS* 2017;21(1):28-33 e2. doi: 10.1016/j.jaapos.2016.11.020 [published Online First: 2017/01/21]

4. Maguire SA, Watts PO, Shaw AD, et al. Retinal haemorrhages and related findings in abusive and non-abusive head trauma: a systematic review. *Eye (Lond)* 2013;27(1):28-36. doi: 10.1038/eye.2012.213 [published Online First: 2012/10/20]

5. Maguire S, Pickerd N, Farewell D, et al. Which clinical features distinguish inflicted from non-inflicted brain injury? A systematic review. *Arch Dis Child* 2009;94(11):860-7. doi: 10.1136/adc.2008.150110 [published Online First: 2009/06/18]

6. Maguire SA, Kemp AM, Lumb RC, et al. Estimating the probability of abusive head trauma: a pooled analysis. *Pediatrics* 2011;128(3):e550-64. doi: 10.1542/peds.2010-2949 [published Online First: 2011/08/17]

7. Kaur B, Taylor D. Fundus hemorrhages in infancy. *Surv Ophthalmol* 1992;37(1):1-17. [published Online First: 1992/07/01]

8. Hughes LA, May K, Talbot JF, et al. Incidence, distribution, and duration of birth-related retinal hemorrhages: a prospective study. *Journal of AAPOS : the official publication of the American Association for Pediatric Ophthalmology and Strabismus / American Association for Pediatric Ophthalmology and Strabismus* 2006;10(2):102-6. doi: 10.1016/j.jaapos.2005.12.005

9. Watts P, Maguire S, Kwok T, et al. Newborn retinal hemorrhages: a systematic review. *J AAPOS* 2013;17(1):70-8. doi: 10.1016/j.jaapos.2012.07.012 [published Online First: 2013/02/01]

10. Maguire SA, Lumb RC, Kemp AM, et al. A Systematic Review of the Differential Diagnosis of Retinal Haemorrhages in Children with Clinical Features associated with Child Abuse. *Child Abuse Review Published Online in Wiley Online Library (wileyonlinelibrarycom) DOI:101002/car2224* 2012

11. Levin AV. The SBU report: a different view. *Acta Paediatr* 2017 doi: 10.1111/apa.13834

12. Jayawant S, Rawlinson A, Gibbon F, et al. Subdural haemorrhages in infants: population based study. *BMJ* 1998;317(7172):1558-61. [published Online First: 1998/12/04]

13. Ng WS, Watts P, Lawson Z, et al. Development and validation of a standardized tool for reporting retinal findings in abusive head trauma. *Am J Ophthalmol* 2012;154(2):333-39 e5. doi: 10.1016/j.ajo.2012.02.007 [published Online First: 2012/05/01]