Introduction:
Accumulating evidence shows that fluid overload is independently associated with adverse outcome in children and adults with acute lung injury. Fluid restriction initiated early in the disease process may prove beneficial, potentially by diminishing the formation of interstitial edema. The main goal of this study was to determine the short-term biophysical effects of intravenous (IV) fluid restriction during acute lung injury in relation to age.

Methods:
Infant (2-3 weeks) and adult (3-4 months) Wistar rats were mechanically ventilated (MV) 24 hours after intratracheal inoculation with lipopolysaccharide to model acute lung injury. Both age groups were randomized to either a normal or restrictive IV fluid regimen during 6 hours of MV. Thereafter the rats were sacrificed and studied for markers of interstitial edema formation (wet-dry weight ratios), lung permeability (total protein and alpha-2 macroglobulin (A2M) in bronchoalveolar lavage; BAL) and local inflammation (cell counts and cytokines in BAL).

Results:
Restrictive fluid therapy was not associated with worsening of hemodynamic indices during the period of MV in either infant or adult rats. However, as compared to the normal fluid regimen, restrictive fluid therapy led to lower wet-dry weight ratios of the lungs and kidneys in adult rats (p < 0.05), but not in infants (Figure 1 and 2). No difference was found in total protein and A2M in BAL between the two fluid regimens in both age groups. Also, neutrophil influx in the lungs did not differ between fluid regimens in both age categories, nor did the influx of inflammatory cytokines IL-6 and MIP-2 in BAL fluid.

Conclusion:
There is an age-dependent effect of early fluid restriction on the formation of interstitial edema in local and distant organs in the disease process of acute lung injury. Further investigation of the effects of fluid therapies in experimental models may help steering towards better treatment in critically ill patients.
Figure 1: Lung wet-dry weight ratio. There is a significant difference between normal and restrictive fluid regimen in adult rats, however not in infants. Data are presented as median and interquartile range (IQR); whiskers present 1.5 IQR. * p<0.05

Figure 2: Kidney wet-dry weight ratio. There is a significant difference between normal and restrictive fluid regimen in adult rats, however not in infants. Data are presented as median and interquartile range (IQR); whiskers present 1.5 IQR. * p<0.05