

# Survey of pediatrics patient exposure in radiography examinations

• **J.Ziliukas<sup>\*1</sup>, J.Marcinkevicius<sup>2</sup>, A.Usaite<sup>3</sup>, L.Krynke<sup>4</sup>, B.Pakalniskiene<sup>5</sup>, E.Stasiene<sup>6</sup>  
J.Mazuoliene<sup>7</sup>, G.Setikiene<sup>8</sup>**

• *1,2,3,4 Radiation Protection Centre, Vilnius, Lithuania*

• *5 Klaipeda Children Hospital, Klaipeda, Lithuania*

• *6 Children's Hospital at Vilnius University, Vilnius, Lithuania*

• *7 Kaunas Medical University Hospital, Kaunas, Lithuania*

• *8 Siauliai District Hospital, Siauliai, Lithuania*

• *\* Presenting author: [j.ziliukas@rsc.lt](mailto:j.ziliukas@rsc.lt)*



# Introduction and Purposes

- Increasing of X-ray diagnostic techniques in the last years and implementation of new, mainly digital technologies cause the increasing of number of the X-ray examinations and influence collective dose from medical exposures over the world. The most sensitive group of peoples are pediatric patients affected by ionizing radiation. The justification and optimization of X-ray examinations for this group should take special attention. The establishing of diagnostic reference levels (DRLs) is one of significant tools for reducing and managing of patient doses. Radiation Protection Centre (RPC) started survey of the exposure doses for pediatric patients in radiography for further assessment and establishing of DRLs.



# Method

- For the beginning in this survey the exposure doses of pediatric patients have been collected in two children hospitals and two large hospitals with separate X-ray rooms for children X-ray examinations. For measurements of doses were used KAP meters. The exposure doses, exposure parameters and patients data were collected for skull, chest, spine and abdomen X-ray examinations. The exposure doses were collected for children from newborns till 15 years age divided to four groups of age.



# Results

Since 2009, more than 1500 children exposure doses (in terms of KAP, Gy×cm<sup>2</sup>) was measured and data collected for assessment of doses in conventional pediatric X-ray examinations

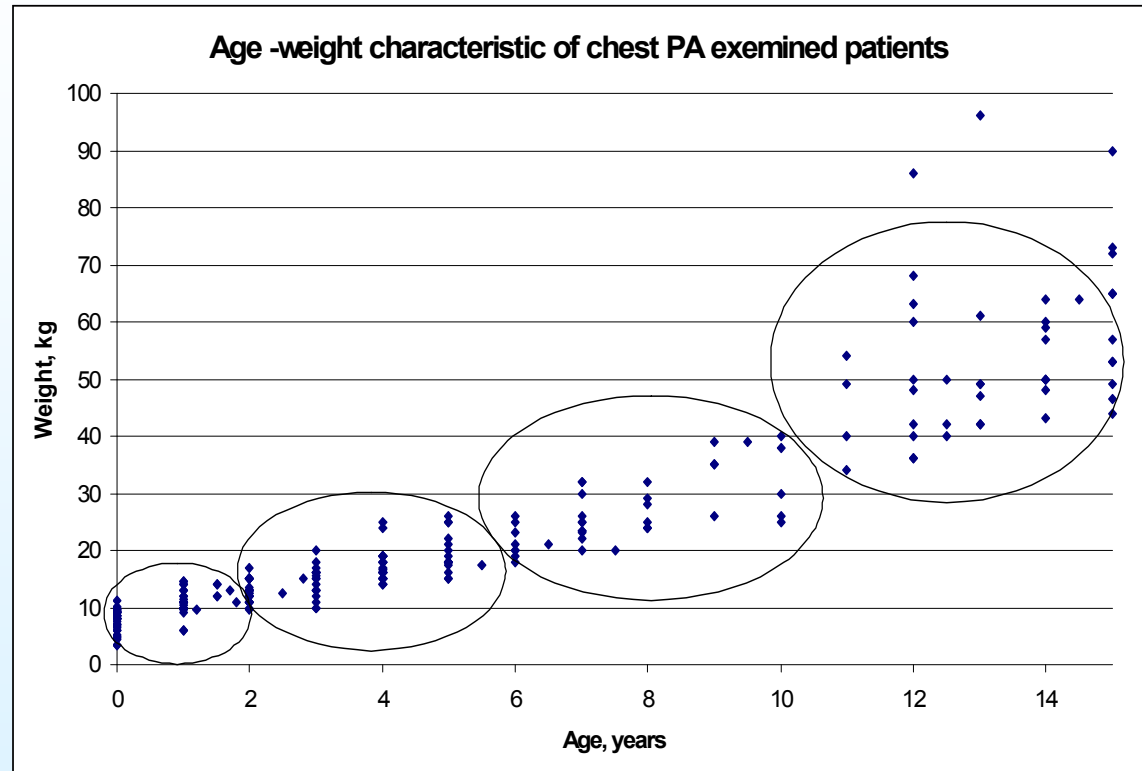
**Distribution of the number of examinations in survey since 2009**

Hospital	Type of X-ray examination					
	Chest PA	Spine AP/PA	Spine LAT	Skull AP/PA	Skull LAT	Abdomen AP
1	432	106	65	124	123	0
2	81	0	0	52	52	24
3	111	22	19	150	2	75
4	56	31	13	7	5	1
<b>Total</b>	<b>680</b>	<b>159</b>	<b>97</b>	<b>333</b>	<b>182</b>	<b>100</b>

# Results

- The KAP values were recorded for all children from newborn till 15 years teenagers. The children was divided to for age groups taking to account also weight. As show figures of age-weight distribution weight of children up to 10 years rise “smoothly” and up to 10 years old the weight varying quite wide.

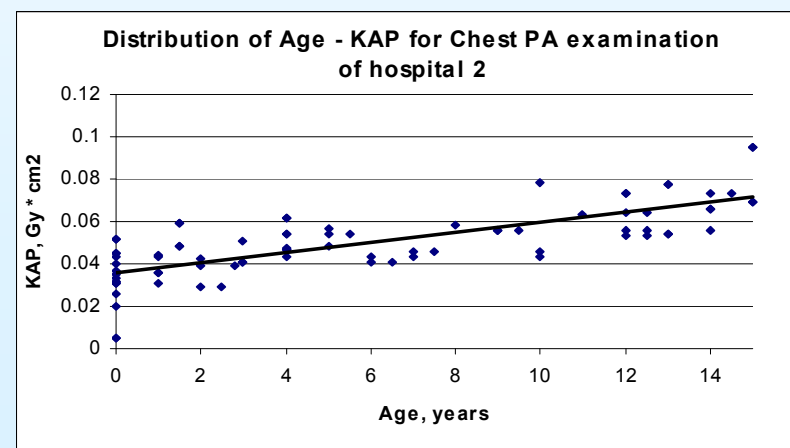
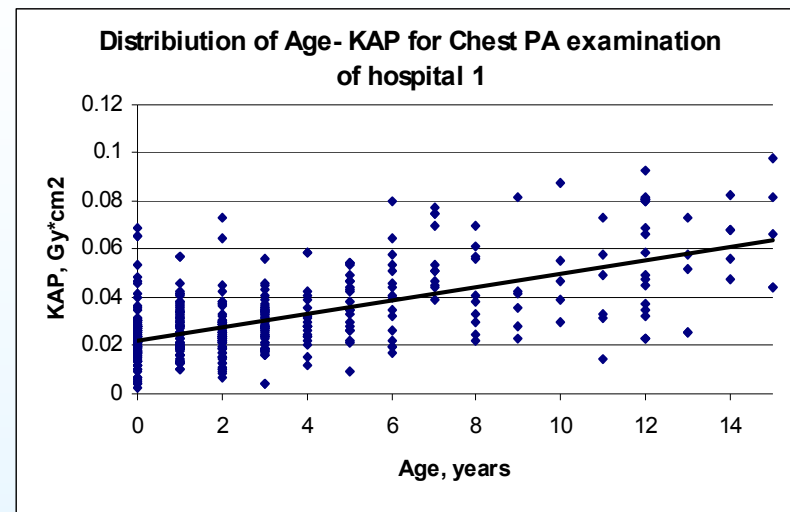
- The evaluation of used kV and mAs show that selecting of parameters did not depend on age sufficiently. The hospitals used different intervals of kV and it seems that KAP values mainly depend on opened field size.



# Results

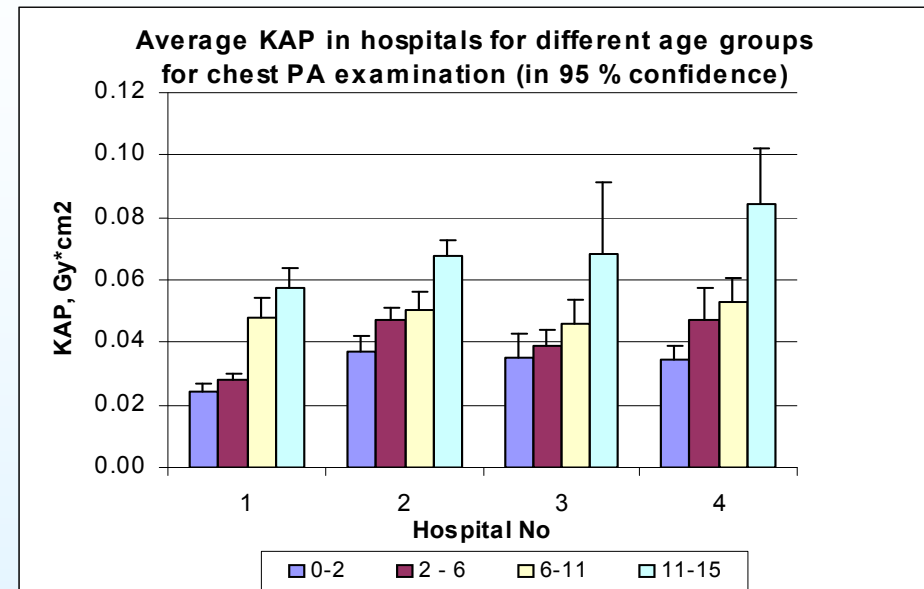
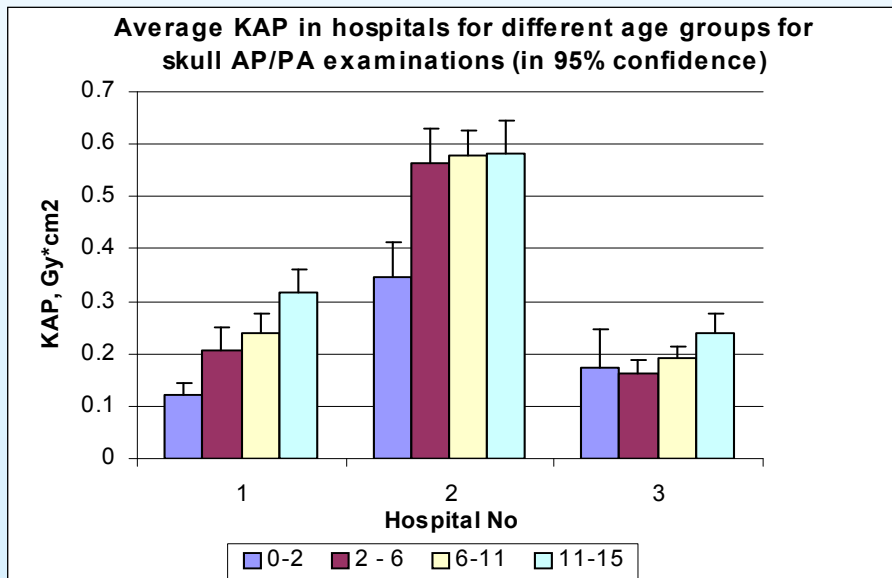
•The kerma air product (KAP) increasing linear with age of children but for hospitals with large numbers of measured patients the spread of KAP in one age group is wide. The maximum and minimum KAP in such hospitals between age groups are not very differ.

•The average KAP values for chest PA, skull AP/PA and skull LAT are  $(0.04 \pm 0.004) \text{Gy} \times \text{cm}^2$ ,  $(0.17 \pm 0.03) \text{Gy} \times \text{cm}^2$  and  $(0.15 \pm 0.02) \text{Gy} \times \text{cm}^2$  respectively for age group 0-1,  $(0.04 \pm 0.003) \text{Gy} \times \text{cm}^2$ ,  $(0.22 \pm 0.03) \text{Gy} \times \text{cm}^2$  and  $(0.21 \pm 0.04) \text{Gy} \times \text{cm}^2$  for age group 2-5,  $(0.05 \pm 0.004) \text{Gy} \times \text{cm}^2$ ,  $(0.26 \pm 0.03) \text{Gy} \times \text{cm}^2$  and  $(0.27 \pm 0.03) \text{Gy} \times \text{cm}^2$  for age group 6-10 and  $(0.07 \pm 0.006) \text{Gy} \times \text{cm}^2$ ,  $(0.32 \pm 0.04) \text{Gy} \times \text{cm}^2$  and  $(0.37 \pm 0.05) \text{Gy} \times \text{cm}^2$  for age group 11-15.



# Results

- The KAP values ratio did not show big differences between hospitals for chest PA examinations in different age groups and were from 1.2 up to 1.7.
- For skull (both AP/PA and LAT) examinations this ratio was significantly higher and in age group from 2 to 6 years was 3.5.



- The less average KAP values in one of hospitals for children of age group 2-6 then average KAP of youngest group probably are because orbits examination were performed for part of patients and smaller field sizes were used.

# Conclusions

- First evaluation show that for abdomen and spine examinations statistic is not good and need further data collection in each of age groups
- The KAP values differ between hospitals for some examinations more than three times
- The difference between measured exposure doses of children shows that some hospitals should take optimization actions
- It is need to check what X-ray parameters influent KAP values and how it depend on age of children and what recommendations use hospitals for selecting X-ray parameters.
- The data is not enough for total assessment exposure doses in conventional pediatric radiography and establishing of DRLs
- The survey should be expanded to other hospitals using the X-ray rooms for both adults and children examinations.

