

## **Patients perception of ionising radiation risks in CT ionising exposure. Does dose bill works?**

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## Aims and objectives

Communicating to patients the magnitude of risk related to ionizing radiation exposure is problematic because of the uncertainty in estimates derived principally from epidemiological studies of large populations [1-6]. Euratom directive 59/2013 requires that dose bill will be part of the radiological report in European Countries [7]. However, how a risk is framed has a profound effect on risk perception. To date, no previous studies evaluated which could be the best way to make patient friendly dose bill. Our aim was to evaluate patients' perception of radiation exposure related to routine CT and their understanding after dose bill.

## Methods and materials

Cross-sectional survey was carried out in 50 patients (mean age  $58,9 \pm 17,5$  years) referred for CT scan to our Department. Patients' characteristics are summarized in Table 1. A questionnaire which tested patients' information about ionizing radiation due to CT was administered (see Table 2). Before the questionnaire all the patients had been informed of their dose bill in CT as CTDI and DLP: 30% of the patients received dose bill orally (group a), 34% writtenly (group b) and 36% writtenly together with information on radiation dose exposure in CT compared to x-ray and on risk level related to the dose (group c). The information on radiation dose provided to group c are reported in Figure 1. Then we evaluated data considering patients' level of school education. P values  $< 0.05$  were considered to be statistically significant.

**Images for this section:**

<b>Gender</b>	
M (number of patients)	23
F (number of patients)	27
<b>Age</b>	
Mean age (years old)	58,9
Standard deviation(years old)	14,4
Age range (years old)	24-84
<b>School education</b>	
Illiterate (number of patients)	1
Primary school (number of patients)	16
Middle school (number of patients)	21
Secondary school (number of patients)	9
Bachelor's degree (number of patients)	3

**Table 1:** Characteristics of the patients: gender, age and level of school education.

1)Have you understood dose bill?
2)Which modality exposes to more radiation: a single CT scan or a generic x-ray? -CT scan - Generic x-ray or CT scan=generic x ray
3)Would you undergo a CT scan just for a personal doubt even if in absence of a medical indication?
4)Do you think that pregnancy is a risk condition for ionizing radiation exposure?
5) Do you think that is possible to keep in touch with pregnant women and children after CT exposure?

**Table 2:** Main question asked after CT scan.

Dear patient,

ionizing radiation exposure for a single chest radiography is lower than due to a transoceanic flight (i.e. flight Italy-USA), but a single generic CT exposes to an higher dose of ionizing radiation compared to chest radiographies as shown below:

DIAGNOSTIC PROCEDURE	N° OF EQUIVALENT CHEST RADIOGRAPHIES
HEAD CT	40
CHEST CT	180
ABDOMINAL CT	300

Moreover, there is a background radiation which we are all constantly exposed; in the table below we provide you data on the time needed for receiving an equivalent background radiation from different examinations:

DIAGNOSTIC PROCEDURE	TIME EQUIVALENT BACKGROUND RADIATION
CHEST RADIOGRAPHY	2,4-12 DAYS
HEAD CT	8 MONTHS
CHEST CT (HR)	5 YEARS
ABDOMINAL CT	2,5 YEARS

Finally, we provide you information on the level of ionizing exposure risk based on effective dose:

LEVEL OF RELATIVE RISK	EFFECTIVE DOSE
NONE	0
MINIMAL	<0,1 mSv
LOW	0,1-1,0 mSv
MEDIUM	1,0-10 mSv
HIGH	10-100 mSv

EXAMINATION	LEVEL OF RISK	DOSE RANGE (mSv)
HEAD CT	MEDIUM	0,9-4
CHEST CT	MEDIUM	4-18
ABDOMINAL CT	MEDIUM	3,5-25

**Fig. 1:** Written information on ionizing radiation exposure from CT provided to group c after CT.

## Results

Comparing answers of the three groups, there was a statistically significant difference ( $p=0,01$ ) in understanding dose bill data and that CT has more radiation than x-ray in group c compared to group b (Table 3). Moreover, there was a statistically significant difference in understanding that is possible to keep in touch with children and pregnant women after CT ( $p=0,01$ ) and that CT should be performed just in case of a real medical indication ( $p=0,03$ ) in group c compared to group a (Table 3). Finally there was a significant difference in the answers due to level of school education (degree obtained), as shown in Table 4.

### Images for this section:

	GROUP A VS GROUP B VS GROUP C	GROUP A VS GROUP C	GROUP B VS GROUP C
QUESTION 1	0,09	0,11	0,03
QUESTION 2	0,04	0,06	0,01
QUESTION 3	0,08	0,03	0,21
QUESTION 4	0,72	0,44	0,65
QUESTION 5	0,03	0,01	0,14

**Table 3:** P values obtained comparing answers to the main questions of the questionnaire among the three groups. Statistically significant p values are written in red.

QUESTION	ANSWER	ILLITERATE/PRIMARY SCHOOL	SECONDARY SCHOOL/BACHELOR'S DEGREE
1)	YES	10	4
	NO	28	8
2)	TC≤RX	7	4
	TC>RX	33	8
3)	YES	24	4
	NO	16	8
4)	YES	20	4
	NO	20	8
5)	NO	25	5
	YES	15	7

**Table 4:** Answers to the main questions of the questionnaire according to level of school education

## Conclusion

Dose bill should be given to patients in order to make them truly aware of the risks related to ionizing radiation exposure. This message is better conveyed providing not just dose bill but also written information on radiation dose exposure in CT compared to x-ray and on risk level related to the dose. Personalized medicine is an "approach of medical practice, when the individual clinical, genetic, genomic and environmental features of the patient determine the intervention of choice to prevent or treat a disease". Since patients' understanding also depends on their school education, it could be useful to evaluate the impact of different written sheets for conveying those information in different ways according to patients' level of education.

## Personal information

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