

## Survey Scope and Structure

The U.S. Food and Drug Administration Center for Devices and Radiological Health (CDRH) collaborates with the Conference of Radiation Control Program Directors (CRCPD) in a unique federal-state partnership to characterize the radiation doses patients receive and to document the state of the practice of diagnostic radiology. Every few years the Nationwide Evaluation of X-ray Trends (NEXT) survey program selects a particular radiological examination for study and captures radiation exposure data from a nationally representative sample of clinical facilities in the USA. In 2014-2015 a survey of facilities that perform dental radiography was conducted, capturing data from 199 randomly identified dental practices in 25 states. The surveys were performed by personnel from the participating states' radiation control agencies.

The survey consists of four components:

1. A section dedicated to the general facility practice, where data were collected on the type of x-ray units present at the dental clinic, facility workload and exam type (adult/pediatrics), information on film processing and quality control procedures.
2. Data regarding intraoral x-ray technological characteristics (e.g. stationary/handheld and film/digital), patient workload and exposure settings, typical patient doses, image quality, and half-value layer. The most frequently used intraoral unit was surveyed for this survey section. For dental clinics equipped with both intraoral and handheld units, only the handheld unit most frequently used was surveyed.
3. A section dedicated to data on panoramic unit technical characteristics, patient workload and x-ray exposure settings for adult/pediatric patients.
4. Data regarding cone-beam computed tomography (CBCT) systems, specifically technical characteristics, patient workload and x-ray exposure settings for adult / pediatric patients.

## Data for Your Facility

The charts below, with values drawn from preliminary dental NEXT survey data, can be used to compare your facility's practice with that of the representative survey sample for different dental exams. These survey results are NOT recommended performance levels or diagnostic reference levels, but rather are statistical indicators of the state of practice at the time of survey. NOTE: Certain survey outcomes (e.g. number of visible meshes) require the use of the NEXT dental phantom.

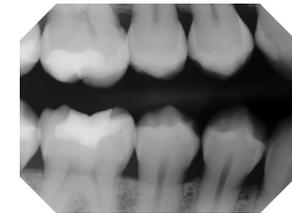
INTRAORAL UNIT	Survey median values		
	Your Results	Stationary	Handheld
Exposure Time adult (ms)		160	170
Exposure Time pediatric (ms)		100	135
Tube current (mA)		7	2.5
Clinical kVp		70	60
Exposure adult (mR) <sup>a</sup>		109	57
Exposure pediatric (mR)		77	48

<sup>a</sup>1.0 mGy = 1.0 mR x 0.00876

EXTRAORAL UNIT	Survey median values		
	Your Results	Panoramic	CBCT
Exposure Time adult (s)		13.9	11.3
Exposure Time ped (s)		13.7	7.5
Tube current (mA)		8	6

# Nationwide Evaluation of X-Ray Trends

## 2014-2015 Dental Radiography



Conference of Radiation Control Program Directors



and

The Center for Devices and Radiological Health, U.S. Food and Drug Administration

with support from

American College of Radiology

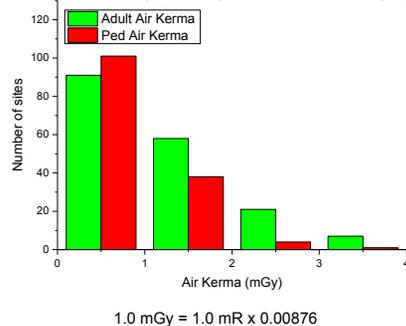
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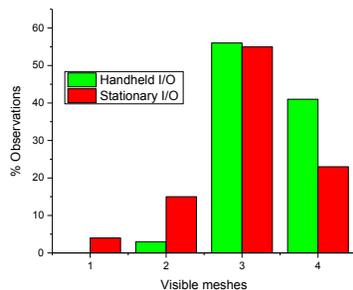
## Survey Results Intraoral Systems

A typical dental office in the USA takes, on average, 82 intraoral (I/O) radiographs a week. All handheld dental units have digital sensors. The percentage of digital stationary I/O digital systems is 83% (as of 2015). The film of choice used by analog I/O dental x-ray systems is D-speed film. The vast majority of stationary dental systems have circular collimators. On average, 6 intraoral radiographs per dental imaging exam were obtained for adult patients and about half that for pediatric patients. As see in the figure below, the dose for an I/O exam is typically below 1 mGy per radiograph.



### Image Quality of Intraoral Systems

As shown below, the image quality for handheld units (avg=3.4 visible meshes, N=32) is superior to the image quality of 2.9 meshes for stationary systems (N=139).



Intraoral image quality was determined to be better for digital systems (average value 3 visible meshes, N=144) than for film/screen (2 visible meshes, N=25).

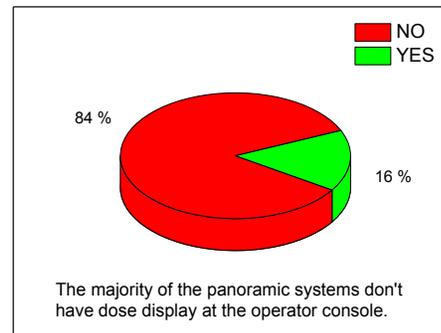
## Survey Results Panoramic Systems

- The statistics below are calculated from a sample of 115 surveyed facilities equipped with panoramic units.
- About half of all surveyed dental facilities have panoramic units for extraoral imaging.
- 79% of surveyed panoramic units are digital.
- Only 1 panoramic unit in 5 also has a CBCT imaging mode.

### Typical Technique Factors (Average Values) for Panoramic Radiography

TECHNIQUE FACTORS	KVp	Expo Time (s)	mA
Adult	72.7	14.1	8.3
Pediatric	69.5	13.6	7.7

- A typical dental facility performs panoramic exams on 9.4 adults per week and 6 pediatric patients per week.
- As depicted by the chart below, only 16% of surveyed panoramic systems are able to display patient dose at the console.



More information on the NEXT surveys is available from CRCPD ([www.crcpd.org](http://www.crcpd.org)) or from the Food and Drug Administration (301-796-6631).

## Survey Results for Cone-Beam CT (CBCT) Systems

- The statistics below are calculated from a sample (N=28) of surveyed facilities equipped with CBCT units.
- 85% of units have affixed certification labels.
- The vast majority of CBCT unit operators (9 out of 10) are trained on-site.

### Typical Technique Factors (Average Values) for CBCT Radiography

TECHNIQUE FACTORS	KVp	Expo Time (s)	mA
Adult	100.6	12.5	8.0
Pediatric	99.5	8.0	6.8

- A CBCT-ready facility typically performs CBCT imaging exams on 10 adults, 3 adolescents and 1 child per week.
- Due to higher patient doses, dental practices seem to be cautious when using CBCT on children. If a dental practice has both CBCT and panoramic systems, only 17% of pediatric extraoral examinations are performed using CBCT. By comparison, the ratio is about half CBCT/ half panoramic for extraoral examinations of adult patients (data collected from 12 facilities with both CBCT and panoramic systems).

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