Course 2 – Diagnostic Imaging

Clinical Dosimetry in Paediatric Imaging

Wesley Bolch, PhD
Member, ICRP Committee 2
Chair, Task Group on Dose Calculations

IAEA IDOS Symposium – Course 2
November 11, 2010

The MIRD Schema

SPECIAL CONTRIBUTION

MIRD Pamphlet No. 21: A Generalized Schema for Radiopharmaceutical Dosimetry—Standardization of Nomenclature

Wesley E. Bolch[1], Keith F. Eckerman[2], George Sgouros[3], and Stephen R. Thomas[4]

In collaboration with the SNM MIRD Committee: Wesley E. Bolch, A. Bertrand Brill, Darrell R. Fisher, Roger W. Howell, Ruby Meredith, George Sgouros, Stephen R. Thomas (Chair), and Barry W. Wessels.

Objective –

- ***Restate the MIRD schema for assessment of absorbed dose in a manner consistent with the needs of both the nuclear medicine and radiation protection communities with the goal of standardizing nomenclature***
- ***Adopt the quantities equivalent and effective dose for assessment of stochastic risk***
- ***Review dose quantities relevant to deterministic effects***

J Nucl Med 2009; 50:477–484
DOI: 10.2967/jnumed.108.056036

The MIRD Schema – Time Dependent

Mean absorbed dose rate to target tissue r_T is given as:

$$\dot{D}(r_T,t) = \sum_{r_S} A(r_S,t)\ S(r_T \leftarrow r_S\ ,t)$$

Activity in source tissue r_S at time t

Absorbed dose rate in r_T per unit activity in r_S

Summation over all source tissues r_S

The MIRD Schema – Time Dependent

Mean absorbed dose over dose integration period T_D

$$D(r_T, T_D) = \int_0^{T_D} \dot{D}(r_T, t)\, dt = \sum_{r_S} \int_0^{T_D} A(r_S, t)\, S(r_T \leftarrow r_S, t)\, dt$$

S value – absorbed dose rate in r_T per unit activity in r_S

Fraction of particle energy absorbed in r_T that is emitted in r_S

$$S(r_T \leftarrow r_S, t) = \sum_i E_i Y_i \frac{\phi(r_T \leftarrow r_S, E_i, t)}{M(r_T, t)} = \sum_i \Delta_i \frac{\phi(r_T \leftarrow r_S, E_i, t)}{M(r_T, t)}$$

Mass of target tissue r_T

The MIRD Schema – Time Independent

Mean absorbed dose

$$D(r_T, T_D) = \sum_{r_S} \tilde{A}(r_S, T_D)\, S(r_T \leftarrow r_S)$$

where

$$\tilde{A}(r_S, T_D) = \int_0^{T_D} A(r_S, t)\, dt$$

Mean absorbed dose per unit administered activity A_0

$$\frac{D(r_T, T_D)}{A_0} = d(r_T, T_D) = \sum_{r_S} \tilde{a}(r_S, T_D)\, S(r_T \leftarrow r_S)$$

Absorbed Dose Coefficient

$$\tilde{a}(r_S, T_D) = \int_0^{T_D} a(r_S, t)\, dt = \frac{1}{A_0} \int_0^{T_D} A(r_S, t)\, dt$$

Time-Integrated Activity Coefficient

Assessment of Organ Activity

SPECIAL CONTRIBUTION

MIRD Pamphlet No. 16: Techniques for Quantitative Radiopharmaceutical Biodistribution Data Acquisition and Analysis for Use in Human Radiation Dose Estimates

Jeffry A. Siegel, Stephen R. Thomas, James B. Stubbs, Michael G. Stabin, Marguerite T. Hays, Kenneth F. Koral, James S. Robertson, Roger W. Howell, Barry W. Wessels, Darrell R. Fisher, David A. Weber and A. Bertrand Brill

Conjugate View Method

The conjugate view methods is the most commonly employed imaging method for quantification of activity in vivo. It uses 180^0 opposed planar images in combination with transmission data through the subject and a system calibration factor.

This technique offers an improvement over single-view procedures involving comparison with a standard phantom under fixed geometry in that the formalism provides correction for source thickness, inhomogeneity, and attenuation

Conjugate View Method

Activity in a region of interest (ROI) :

$$A_{ROI} = \sqrt{\frac{I_A I_P}{T}} \frac{f}{C}$$

where

I_A is the count rate (cps) acquired under the anterior view

I_P is the count rate (cps) acquired under the posterior view

T is the transmission factor given by $e^{-\mu_e t}$

with t being the patient thickness over the ROI and
μ_e being the effective attenuation coefficient

f is a correction for photon self-attenuation in the ROI

C is a system calibration factor (cps / Bq)

Current Practice in Paediatric NM

SPECIAL CONTRIBUTION

Administered Radiopharmaceutical Doses in Children: A Survey of 13 Pediatric Hospitals in North America

S. Ted Treves, Royal T. Davis, and Frederic H. Fahey

Division of Nuclear Medicine, Children's Hospital Boston, Harvard Medical School, Boston, Massachusetts

THE JOURNAL OF NUCLEAR MEDICINE • Vol. 49 • No. 6 • June 2008

Current Practice in Paediatric NM

SPECIAL CONTRIBUTION

Administered Radiopharmaceutical Doses in Children: A Survey of 13 Pediatric Hospitals in North America

S. Ted Treves, Royal T. Davis, and Frederic H. Fahey

Division of Nuclear Medicine, Children's Hospital Boston, Harvard Medical School, Boston, Massachusetts

THE JOURNAL OF NUCLEAR MEDICINE • Vol. 49 • No. 6 • June 2008

Fifteen pediatric institutions in North America were contacted and asked to provide information on their respective approaches to administered radiopharmaceutical doses for children. They were asked to complete a survey for 16 pediatric nuclear medicine examinations. The data requested for these procedures included the minimum and maximum administered activities, the schedule used in determining the appropriate administered activity as a function of patient size, and the corresponding factor that is applied (e.g., activity per kg [MBq/kg] or activity per body surface area [MBq/m2]).

Current Practice in Paediatric NM

SPECIAL CONTRIBUTION

Administered Radiopharmaceutical Doses in Children: A Survey of 13 Pediatric Hospitals in North America

S. Ted Treves, Royal T. Davis, and Frederic H. Fahey

Division of Nuclear Medicine, Children's Hospital Boston, Harvard Medical School, Boston, Massachusetts

THE JOURNAL OF NUCLEAR MEDICINE • Vol. 49 • No. 6 • June 2008

In most cases, the reported values for maximum activity and activity per mass varied within a factor of 2, although for some procedures, they varied by as much as a factor of 10. On the other hand, the reported values of minimum activity demonstrated substantially wider variation, by as much as a factor of 20 for some procedures. There are several examples of this wider variation: 99mTc DMSA minimum total doses varied from 5.6 to 74 MBq, whereas the activity per kilogram varied from 1.1 to 3.7 MBq/kg and the maximum dose varied from 74 to 222 MBq.

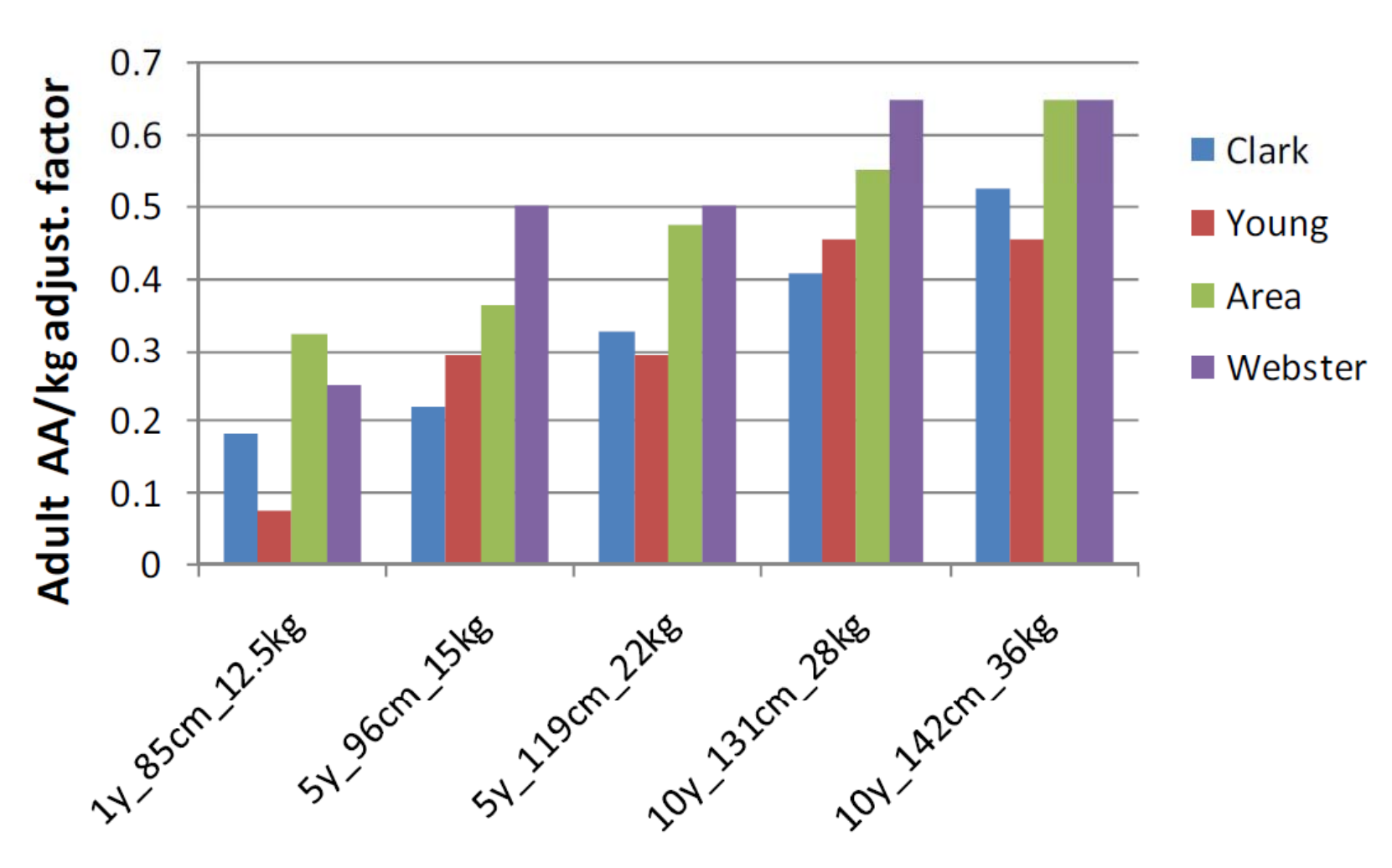
Current Paediatric Dosing Guidelines

Clark's Rule: ***child weight (lbs)/150 lbs x adult AA***
Young's Rule: ***child age in years/(age+12)x adult AA***
Area Rule: ***(pediatric/adult body mass)$^{2/3}$ x adult AA***
Webster's Rule: ***(age+1)/(age+7) x adult AA***
Fried's Rule: ***(child age in months)/150 x adult AA***

Each rule is applied for a particular patient weight/age category. When patients fall into more than one of the above rules, the following applies:

- ***For patients less than one year old use Fried's Rule.***
- ***For patients greater than 1 year old, up to 12 years old and no weight is available, use Webster's Rule.***
- ***For patients with the weight available, and who are at least 40 kg use Clark's Rule.***
- ***For patients less than 40 kg, use the age and Webster's Rule.***
- ***For patients that are at least 12 years in age the adult AA is usually appropriate.***

Current Paediatric Dosing Guidelines

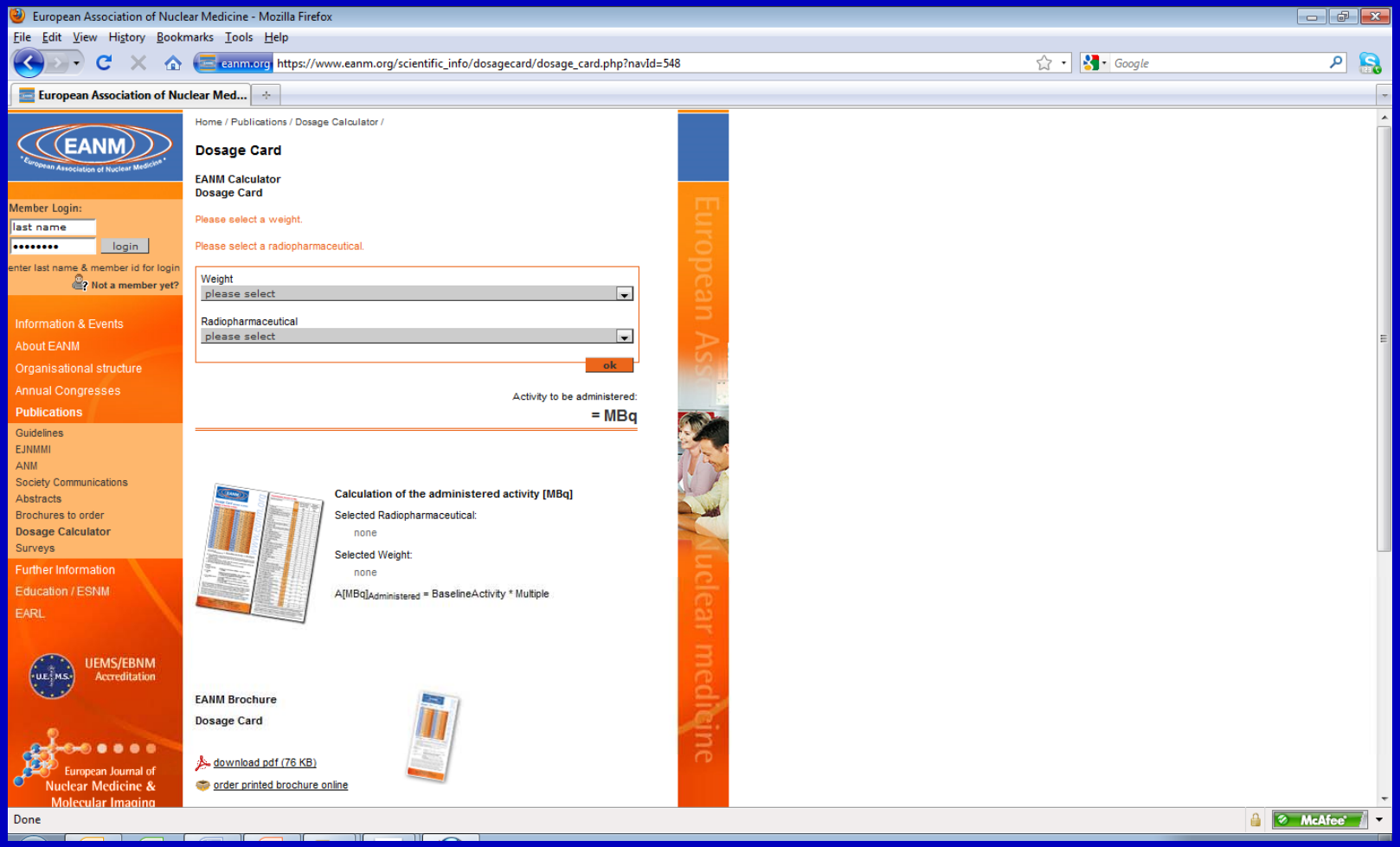


Note – 1.0 on the ordinate refers to simple body mass scaling of adult AA

Current Paediatric Dosing Guidelines

EANM Dosage Card

https://www.eanm.org/scientific_info/dosagecard/dosagecard.php



Current Paediatric Dosing Guidelines

EANM Dosage Card

Eur J Nucl Med Mol Imaging (2007) 34:796–798
DOI 10.1007/s00259-007-0370-0

SPECIAL CONTRIBUTION

The new EANM paediatric dosage card

M. Lassmann · L. Biassoni · M. Monsieurs ·
C. Franzius · F. Jacobs ·
for the EANM Dosimetry and Paediatrics Committees

Optimised tracer-dependent dosage cards to obtain weight-independent effective doses

F. Jacobs[1], H. Thierens[2], A. Piepsz[3], K. Bacher[2], C. Van de Wiele[1], H. Ham[1], R.A. Dierckx[1]

[1] Department of Nuclear Medicine, Ghent University Hospital, Gent, Belgium
[2] Department of Medical Physics, Ghent University, Gent, Belgium
[3] CHU St Pierre, Department of Nuclear Medicine, Brussels, Belgium

Eur J Nucl Med Mol Imaging (2005) 32:581–588
DOI 10.1007/s00259-004-1708-5

Received: 8 March 2004 / Accepted: 23 September 2004 / Published online: 24 December 2004
© Springer-Verlag 2004

Current Paediatric Dosing Guidelines

EANM Dosage Card

https://www.eanm.org/scientific_info/dosagecard/dosagecard.php

- *Each radiopharmaceutical was assumed to be uniformly present in stylized phantoms of the ORNL series*
- *The complement of the whole-body absorbed fraction taken as proportional to the photon fluence available for imaging*
- *Organ and effective dose calculated for each phantom and radiopharmaceutical*
- *Recommended AA were assigned to maximize uniformity in photon fluence and patient effective dose*

Current Paediatric Dosing Guidelines
EANM Dosage Card

$$A[MBq]_{\text{Administered}} = BaselineActivity \times Multiple$$

a) For a calculation of the administered activity, the *baseline* activity value has to be multiplied by the multiples given above for the recommended radiopharmaceutical class (see reverse).
b) If the resulting activity is smaller than the minimum recommended activity, the minimum activity should be administered.
c) The national diagnostic reference levels should not be exceeded!

Current Paediatric Dosing Guidelines
EANM Dosage Card

Dosage Card (Version 1.5.2008)

Multiple of Baseline Activity

Weight kg	Class A	Class B	Class C	Weight kg	Class A	Class B	Class C
3	1	1	1	32	3.77	7.29	14.00
4	1.12	1.14	1.33	34	3.88	7.72	15.00
6	1.47	1.71	2.00	36	4.00	8.00	16.00
8	1.71	2.14	3.00	38	4.18	8.43	17.00
10	1.94	2.71	3.67	40	4.29	8.86	18.00
12	2.18	3.14	4.67	42	4.41	9.14	19.00
14	2.35	3.57	5.67	44	4.53	9.57	20.00
16	2.53	4.00	6.33	46	4.65	10.00	21.00
18	2.71	4.43	7.33	48	4.77	10.29	22.00
20	2.88	4.86	8.33	50	4.88	10.71	23.00
22	3.06	5.29	9.33	52-54	5.00	11.29	24.67
24	3.18	5.71	10.00	56-58	5.24	12.00	26.67
26	3.35	6.14	11.00	60-62	5.47	12.71	28.67
28	3.47	6.43	12.00	64-66	5.65	13.43	31.00
30	3.65	6.86	13.00	68	5.77	14.00	32.33

Recommended Amounts in MBq

Radiopharmaceutical	Class	Baseline Activity (for calculation purposes only) MBq	Minimum Recommended Activity[1] MBq
^{123}I (Thyroid)	C	*0.6*	3
^{123}I Amphetamine (Brain)	B	*13.0*	18
^{123}I HIPPURAN (Abnormal renal function)	B	*5.3*	10
^{123}I HIPPURAN (Normal renal function)	A	*12.8*	10
^{123}I mIBG	B	*28.0*	80
^{131}I mIBG	B	*5.6*	35
^{18}F FDG (2D)[4]	B	*25.9*	26
^{18}F FDG (3D), Recommended in children[4]	B	*14.0*	14
^{18}F Fluorine (2D)	B	*25.9*	26
^{18}F Fluorine (3D), Recommended in children	B	*14.0*	14
^{67}Ga Citrate	B	*5.6*	10
^{99m}Tc ALBUMIN (Cardiac)	B	*56.0*	80
^{99m}Tc COLLOID (Gastric Reflux)	B	*2.8*	10
^{99m}Tc COLLOID (Liver/Spleen)	B	*5.6*	15
^{99m}Tc COLLOID (Marrow)	B	*21.0*	20
^{99m}Tc DMSA	A	*17.0*	15
^{99m}Tc DTPA (Abnormal renal function)	B	*14.0*	20
^{99m}Tc DTPA (Normal renal function)	A	*34.0*	20

[1] The minimum recommended activities are calculated for commonly used gamma cameras or positron emission tomographs. Lower activities could be administered when using systems with higher counting efficiency.

Current Paediatric Dosing Guidelines
EANM Dosage Card

Examples:

a) ^{18}F FDG (WB 3D), 50 kg:	activity to be administered [MBq] = 14.0 x10.71 [MBq] ≈ 150 MBq
b) ^{123}ImIBG, 3 kg:	activity to be administered [MBq] = 28.0 x1 [MBq] = 28 MBq < 80 MBq (Minimum Recommended Activity) **=> activity to be administered: 80 MBq**
c) ^{99m}Tc HMPAO (Brain), 58 kg:	activity to be administered [MBq] = 51.8 x12 [MBq] ≈ 621 MBq This would e.g. exceed the German diagnostic reference level of 550 MBq **=> activity to be administered in Germany: 550 MBq**

Calculation of Organ Doses to Paediatric Patients

$$D(r_T, T_D) = \sum_{r_S} \tilde{A}(r_S, T_D)\, S(r_T \leftarrow r_S)$$

Biokinetic Model *Patient Phantom / Radiation Transport*

Scenario 1

- ***no imaging data or patient-specific phantom is available***
- ***use reference biokinetic models and reference phantom S values***

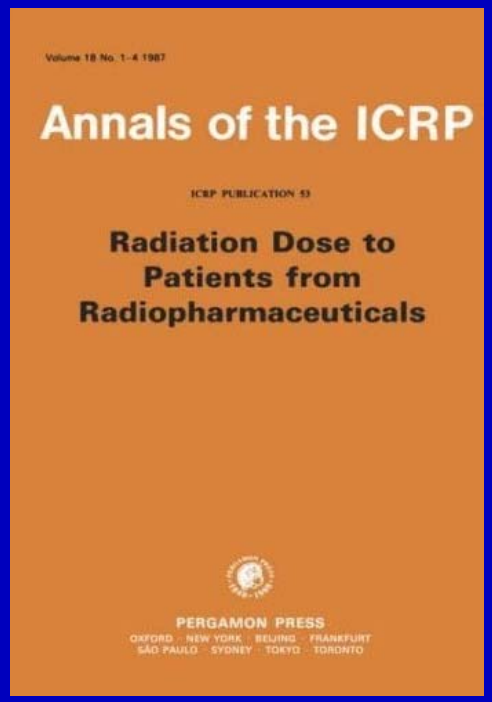
Scenario 2

- ***imaging data available, but no patient-specific phantom***
- ***calculate activity coefficients for each patient***
- ***use reference or mass-adjusted S values***

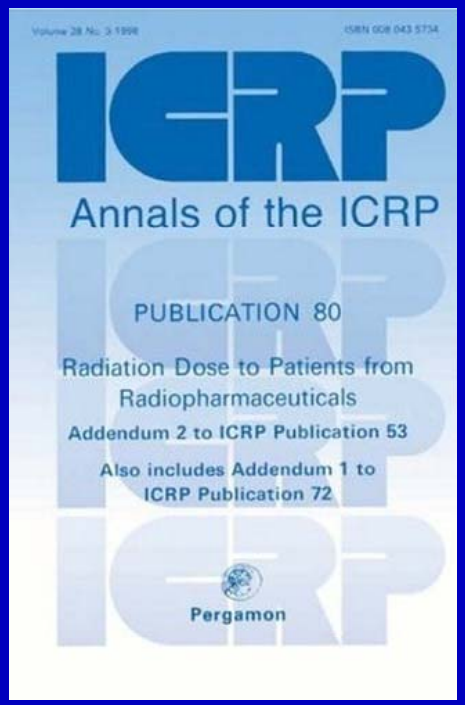
Scenario 3

- ***imaging data available, as well as a patient-specific phantom***
- ***calculate patient-specific activity coefficients***
- ***calculate patient-specific S values***

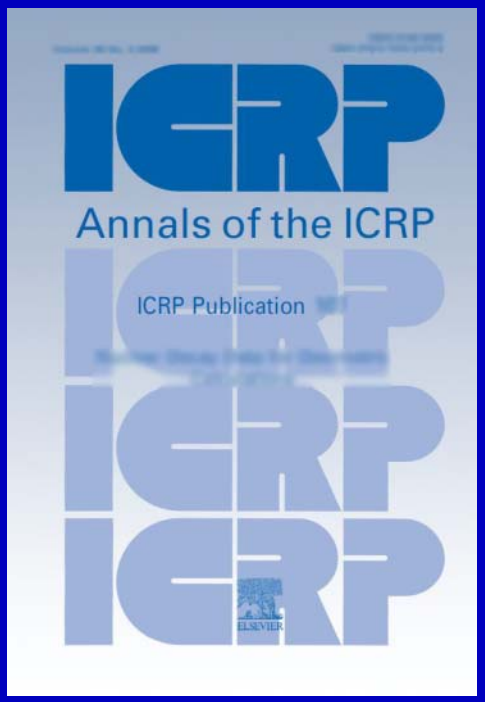
Paediatric Dosimetry Resources - ICRP



ICRP Publication 53



ICRP Publication 80



ICRP Publication 106

Publications from the ICRP C2/C3 Task Group on Radiopharmaceuticals
(Applicable to Scenario 1 – no patient-specific information)

www.icrp.org

Paediatric Dosimetry Resources – ICRP 106

Radiopharmaceutical	This publication	*Publication 80*	*Publication 53*
^{3}H-neutral fat, free fatty acids		x	
^{11}C-acetate	x		
^{11}C-amino acids (generic model)	x		
^{11}C-brain receptor substances (generic model)	x		
^{11}C-methionine	x		
^{11}C-thymidine		x	
^{11}C (realistic maximum model)	x		
^{14}C-neutral fat, free fatty acids		x	
^{14}C-urea		x	
^{15}O-water	x		
^{18}F-amino acids (generic model)	x		
^{18}F-brain receptor substances (generic model)	x		
^{18}F-FDG	x		
^{18}F-L-dopa	x		
^{18}F (realistic maximum model)	x		
^{51}Cr-EDTA		x	
^{67}Ga-citrate		x	
^{68}Ga-EDTA		x	
^{75}Se-amino acids	x		
^{75}Se-HCAT		x	
^{99m}Tc-apticide	x		
^{99m}Tc-colloids (small)	x		
^{99m}Tc-EC	x		
^{99m}Tc-ECD	x		
^{99m}Tc-furifosmin	x		
^{99m}Tc-HIG		x	
^{99m}Tc-HM-PAO		x	
^{99m}Tc-IDA derivatives		x	
^{99m}Tc-MAA		x	
^{99m}Tc-MAG3		x	
^{99m}Tc-markers, non-absorbable		x	
^{99m}Tc-MIBI		x	
^{99m}Tc-monoclonal antibodies/fragments	x		
^{99m}Tc-pertechnegas		x	
^{99m}Tc-pertechnetate		x	
^{99m}Tc-phosphates and phosphonates		x	
^{99m}Tc-RBC		x	x
^{99m}Tc-Technegas		x	
^{99m}Tc-tetrofosmin (rest/exercise)	x		
^{99m}Tc-WBC		x	
^{111}In-HIG		x	

Radiopharmaceutical	This publication	*Publication 80*	*Publication 53*
^{111}In-monoclonal antibodies/fragments	x		
^{111}In-octreotide		x	
^{123}I-iodide			x
^{123}I-fatty acids (BMIPP/IPPA)	x		
^{123}I-brain receptor substances (generic model)	x		
^{123}I-iodo hippurate		x	
^{123}I-MIBG		x	
^{123}I-monoclonal antibodies/fragments	x		
^{124}I-iodide			x
^{125}I-iodide			x
^{131}I-iodide			x
^{131}I-iodo hippurate		x	
^{131}I-monoclonal antibodies/fragments	x		
^{131}I-norcholesterol		x	
^{201}Tl-ion	x		

120 Radiopharmaceuticals considered in these three ICRP Publications

Paediatric Dosimetry Resources – ICRP 106

Following data are given for each radiopharmaceutical:

S	Source organ or tissue
F_s	Fractional distribution to organ or tissue S
T	Biological half-time for an uptake or elimination component
a	Fraction of F_s taken up or eliminated with the corresponding half-time. A minus sign indicates uptake
$\tilde{A}_s/A_o$	Cumulated activity in organ or tissue S per unit of administered activity

With very few exceptions, all ICRP adopted biokinetic models are used for both adults and children.

Pediatric dosimetry values take into consider only pediatric organ masses, pediatric absorbed fractions (ORNL phantoms), and age-dependent blood distribution

Paediatric Dosimetry Resources – ICRP 106

Example – ^{18}FDG:

C.9.1. Biokinetic model

(C 26) ^{18}FDG is a glucose analogue used in the characterisation of glucose metabolism for diagnosis or follow-up of cancer diseases, and for investigation of myocardial and cerebral glucose metabolism. Following intravenous administration, most of the radiopharmaceutical is cleared rapidly from the circulation with a half-time of less than 1 min as it mixes within a large distribution space, although there are longer-term components with half-times of up to 1.5 h. Data from Hays et al. (2002) together with data obtained by Deloar et al. (1998a) are used in this biokinetic model for the dose assessments to patients administered with ^{18}F-FDG. These data confirm the assumption in *Publication 53* (ICRP, 1987) of an uptake of 0.04 to the heart wall, while the uptake to the brain seems to be higher (0.07–0.1) than was given in the *Publication 53* model (0.06).

(C 27) Additionally, there are indications of significant uptake in the liver and the lungs. For liver uptake, values of approximately 0.05 were derived by Deloar et al. (1998a) and Meija et al. (1991). The model of Hays and Segall (1999) predicts a larger uptake in the liver but it decreases rapidly to similar values. For uptake in the lungs, results range from 0.009 (Meija et al., 1991) to 0.029 (Deloar et al., 1998a). Here again, the model by Hays and Segall (2002) indicates a higher uptake followed by a rapid decrease. There are indications that there is a slight increase in activity in the heart and brain, and a steep decrease in activity in the lungs and liver (Meija et al., 1991; Hays and Segall, 1999). It is assumed that all activity is excreted in urine.

(C 28) Based on this information, the following biokinetic model is derived. There is an initial uptake of ^{18}F-FDG in heart (0.04), brain (0.08), liver (0.05), lungs (0.03), and all other tissues (0.8). The retention in the specified source organs is considered to be infinite (without consideration of a delayed uptake). A fraction of 0.3 of the activity in other organs and tissues is considered to be excreted in urine with biological half-times of 12 min (25%) and 1.5 h (75%), according to the kidney–bladder model.

Paediatric Dosimetry Resources – ICRP 106

Example – ^{18}FDG:

C.9.3. Biokinetic data for ^{18}F-FDG

Organ (S)	F_s	T (h)	a	$\tilde{A}_s/A_0$(h)
Brain	0.08	∞	1.0	0.21
Heart wall	0.04	∞	1.0	0.11
Lungs	0.03	∞	1.0	0.079
Liver	0.05	∞	1.0	0.13
Other organs and tissues	0.80	0.20	0.075	1.7
		1.5	0.225	
		∞	0.70	
Urinary bladder contents	0.24			
Adult, 15 years, 10 years				0.26
5 years				0.23
1 year				0.16

Paediatric Dosimetry Resources – ICRP 106

Example – ^{18}FDG:

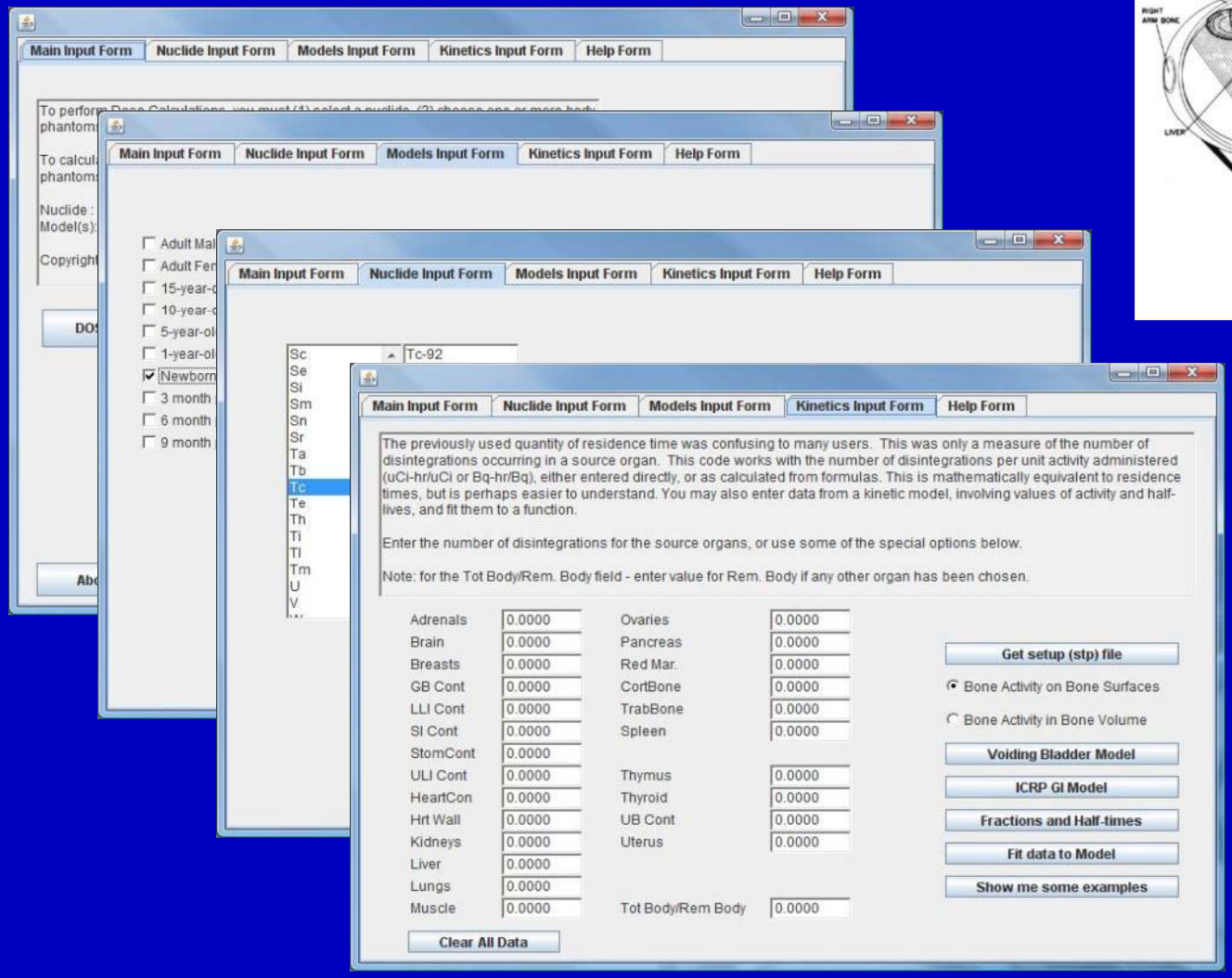
C.9.4. Absorbed doses for ^{18}F-FDG

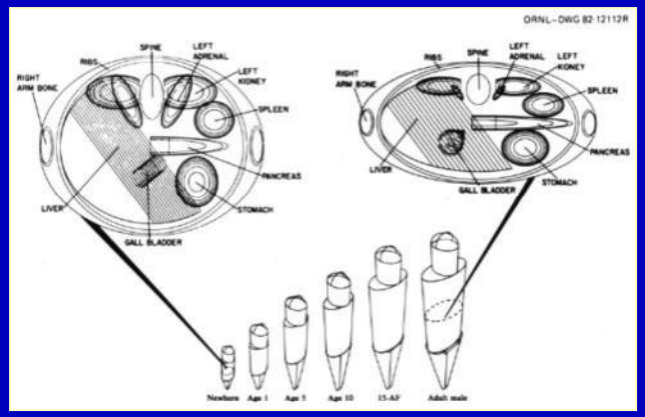
^{18}F 1.83 h

Organ	Absorbed dose per unit activity administered (mGy/MBq)				
	Adult	15 years	10 years	5 years	1 year
Adrenals	1.2E-02	1.6E-02	2.4E-02	3.9E-02	7.1E-02
Bladder	1.3E-01	1.6E-01	2.5E-01	3.4E-01	4.7E-01
Bone surfaces	1.1E-02	1.4E-02	2.2E-02	3.4E-02	6.4E-02
Brain	3.8E-02	3.9E-02	4.1E-02	4.6E-02	6.3E-02
Breasts	8.8E-03	1.1E-02	1.8E-02	2.9E-02	5.6E-02
Gallbladder	1.3E-02	1.6E-02	2.4E-02	3.7E-02	7.0E-02
Gastrointestinal tract					
Stomach	1.1E-02	1.4E-02	2.2E-02	3.5E-02	6.7E-02
Small intestine	1.2E-02	1.6E-02	2.5E-02	4.0E-02	7.3E-02
Colon	1.3E-02	1.6E-02	2.5E-02	3.9E-02	7.0E-02
(Upper large intestine	1.2E-02	1.5E-02	2.4E-02	3.8E-02	7.0E-02)
(Lower large intestine	1.4E-02	1.7E-02	2.7E-02	4.1E-02	7.0E-02)
Heart	6.7E-02	8.7E-02	1.3E-01	2.1E-01	3.8E-01
Kidneys	1.7E-02	2.1E-02	2.9E-02	4.5E-02	7.8E-02
Liver	2.1E-02	2.8E-02	4.2E-02	6.3E-02	1.2E-01
Lungs	2.0E-02	2.9E-02	4.1E-02	6.2E-02	1.2E-01
Muscles	1.0E-02	1.3E-02	2.0E-02	3.3E-02	6.2E-02
Oesophagus	1.2E-02	1.5E-02	2.2E-02	3.5E-02	6.6E-02
Ovaries	1.4E-02	1.8E-02	2.7E-02	4.3E-02	7.6E-02
Pancreas	1.3E-02	1.6E-02	2.6E-02	4.0E-02	7.6E-02
Red marrow	1.1E-02	1.4E-02	2.1E-02	3.2E-02	5.9E-02
Skin	7.8E-03	9.6E-03	1.5E-02	2.6E-02	5.0E-02
Spleen	1.1E-02	1.4E-02	2.1E-02	3.5E-02	6.6E-02
Testes	1.1E-02	1.4E-02	2.4E-02	3.7E-02	6.6E-02
Thymus	1.2E-02	1.5E-02	2.2E-02	3.5E-02	6.6E-02
Thyroid	1.0E-02	1.3E-02	2.1E-02	3.4E-02	6.5E-02
Uterus	1.8E-02	2.2E-02	3.6E-02	5.4E-02	9.0E-02
Remaining organs	1.2E-02	1.5E-02	2.4E-02	3.8E-02	6.4E-02
Effective dose (mSv/MBq)	1.9E-02	2.4E-02	3.7E-02	5.6E-02	9.5E-02

Paediatric Dosimetry Resources – RADAR/OLINDA

Used when patient-specific imaging data are available, yet a patient-specific computational phantom is not available (Scenario 2).





S values based on ORNL stylized phantoms

Future release will use S values from scaled versions of the NCAT adult hybrid phantom

Paediatric Dosimetry Resources – 3D Dose Codes

Scenario 3 – Research level codes that combine 3D quantitative imaging with patient-specific estimates of absorbed dose and radiobiological quantities

Three-Dimensional Radiobiologic Dosimetry: Application of Radiobiologic Modeling to Patient-Specific 3-Dimensional Imaging–Based Internal Dosimetry

J Nucl Med 2007; 48:1008–1016
DOI: 10.2967/jnumed.106.038000

Andrew R. Prideaux[1], Hong Song[1], Robert F. Hobbs[1], Bin He[1], Eric C. Frey[1], Paul W. Ladenson[1,2], Richard L. Wahl[1], and George Sgouros[1]

Method for Fast CT/SPECT-Based 3D Monte Carlo Absorbed Dose Computations in Internal Emitter Therapy

S. J. Wilderman and Y. K. Dewaraja

IEEE TRANSACTIONS ON NUCLEAR SCIENCE, VOL. 54, NO. 1, FEBRUARY 2007

CANCER BIOTHERAPY & RADIOPHARMACEUTICALS
Volume 20, Number 1, 2005
© Mary Ann Liebert, Inc.

The LundADose Method for Planar Image Activity Quantification and Absorbed-Dose Assessment in Radionuclide Therapy

Katarina Sjögreen, Michael Ljungberg, Karin Wingårdh, David Minarik, and Sven-Erik Strand
Department of Medical Radiation Physics, Lund University, Lund, Sweden

Code Names

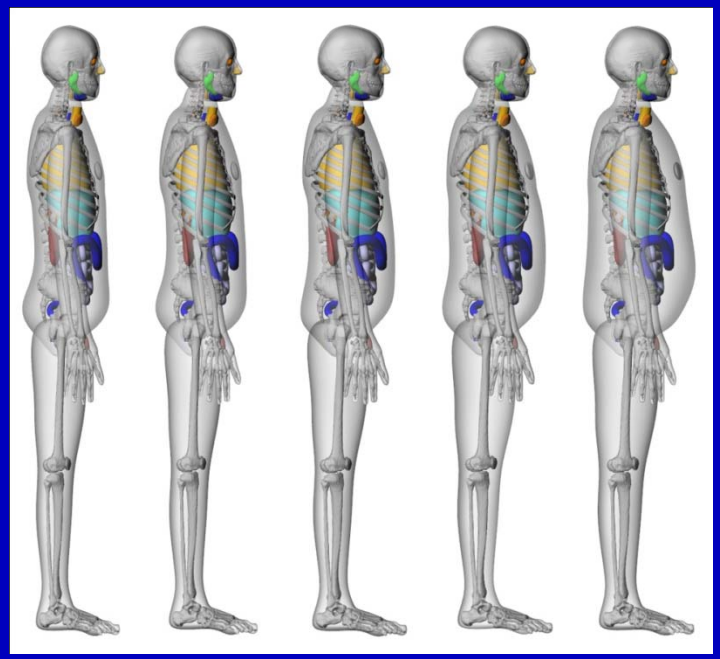
3D-RD

DPM

LundADose

Paediatric Dosimetry Resources

Future options can make use of patient-dependent hybrid phantoms that cover a broad range of patient body morphometries for patient matching



Note – for nuclear medicine, organ shape, depth, and position are important, and will always be approximated using pre-constructed phantom anatomy

Alliance for Radiation Safety in Pediatric Imaging

October 12, 2010

The board of directors at the Society of Nuclear Medicine (SNM) and the Society for Pediatric Radiology (SPR) has approved new North American Guidelines for Radiopharmaceutical Doses for Children. The societies have expanded their pediatric radiation protection initiative by standardizing doses (based on body weight) for 11 nuclear medicine procedures commonly performed in children.

North American Guidelines for Radiopharmaceutical Doses in Children

The consensus guidelines differ significantly from the European Association for Nuclear Medicine (EANM) Pediatric Dose Card in the several important respects:

(a) The administered activities in the consensus guidelines are slightly lower for infants and small children.

(b) Administered activities for 99mTc-DMSA and 18F-fluoride are considerably lower in the consensus guidelines.

(c) Administered activities for orally administered 99mTc-labeled radiopharmaceuticals and for radionuclide cystography provide a range of administered activities for each type of study rather than an administered activity/kg.

(d) The consensus guidelines more closely represent clinical practice in North America pediatric centers.

Questions…