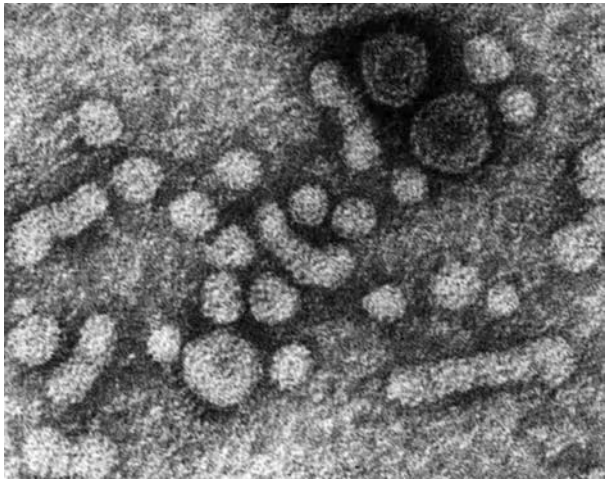
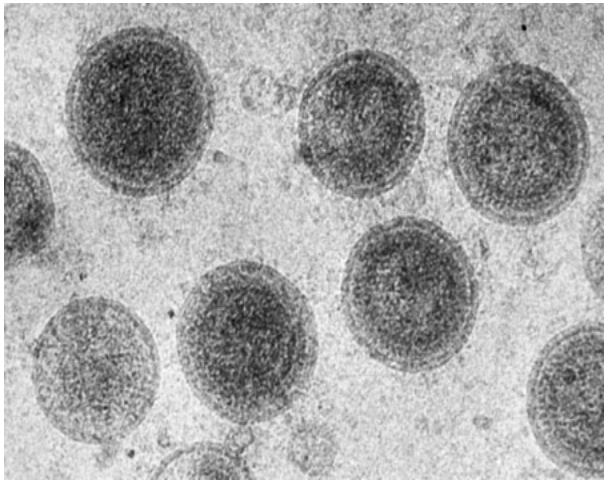
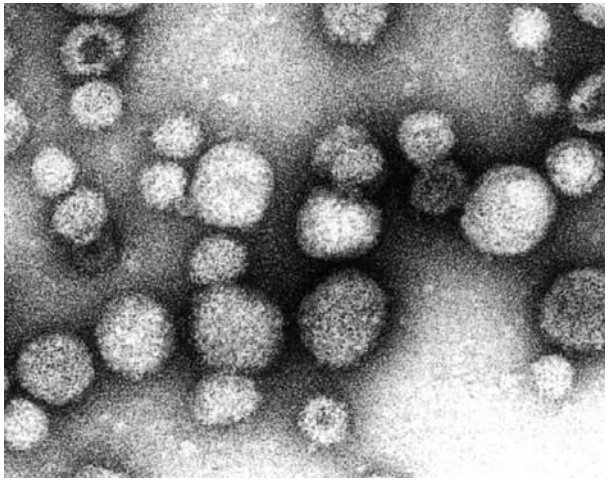
Clinicians who are carrier of HIV, HBV, or HCV: what should they do?

Vincent CC Cheng
Department of Microbiology
Queen Mary Hospital







HBV **HIV** **HCV**

Discovery of blood-borne virus infection

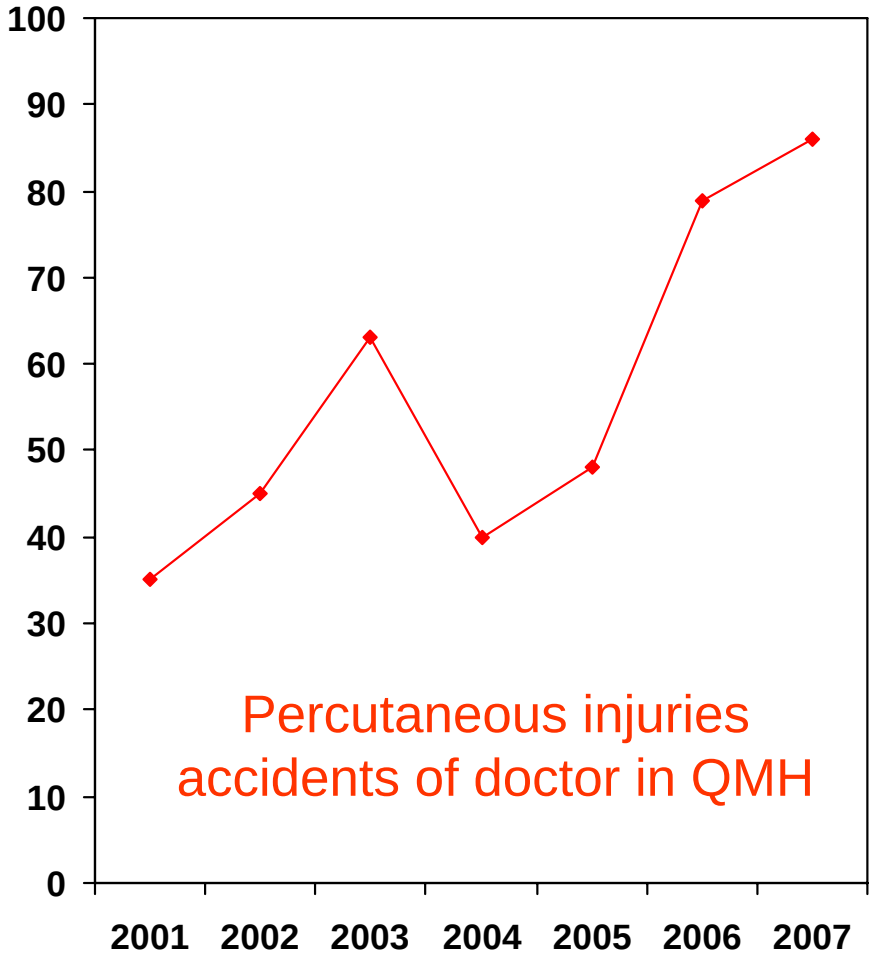
Transmission of blood-borne virus infection

Serological screening of blood donor in Hong Kong

HBV	1977
HIV	1985
HCV	1991

(Data from HK Red Cross)

Transmission of blood-borne virus infection



Transmission of blood-borne virus infection

	Risk of transmission
HBV (eAg+)	33%
HCV (RNA+)	3%
HIV (Ab+)	0.3%

MRSA

Influenza

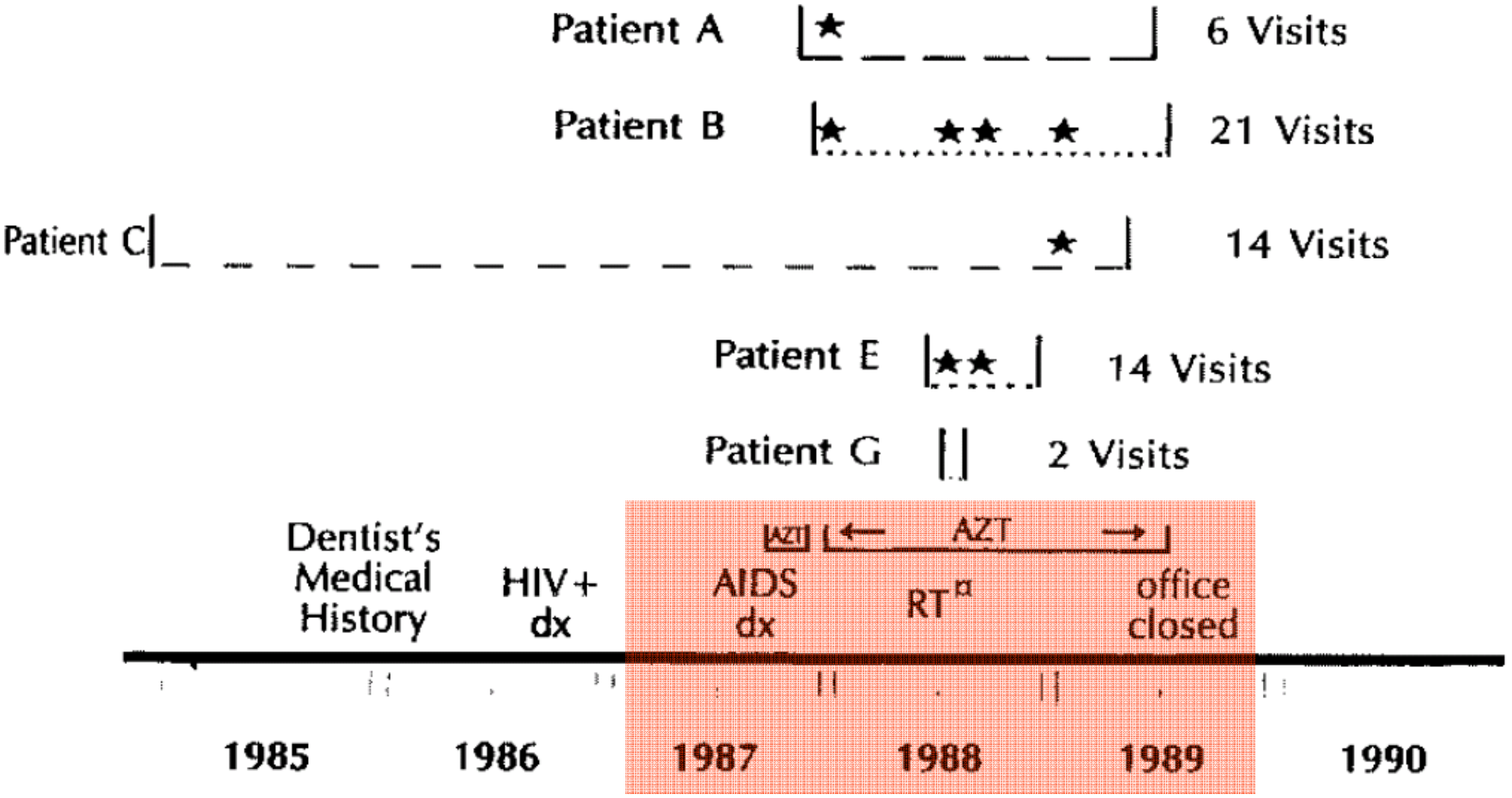
Norovirus

Parvovirus

Varicella

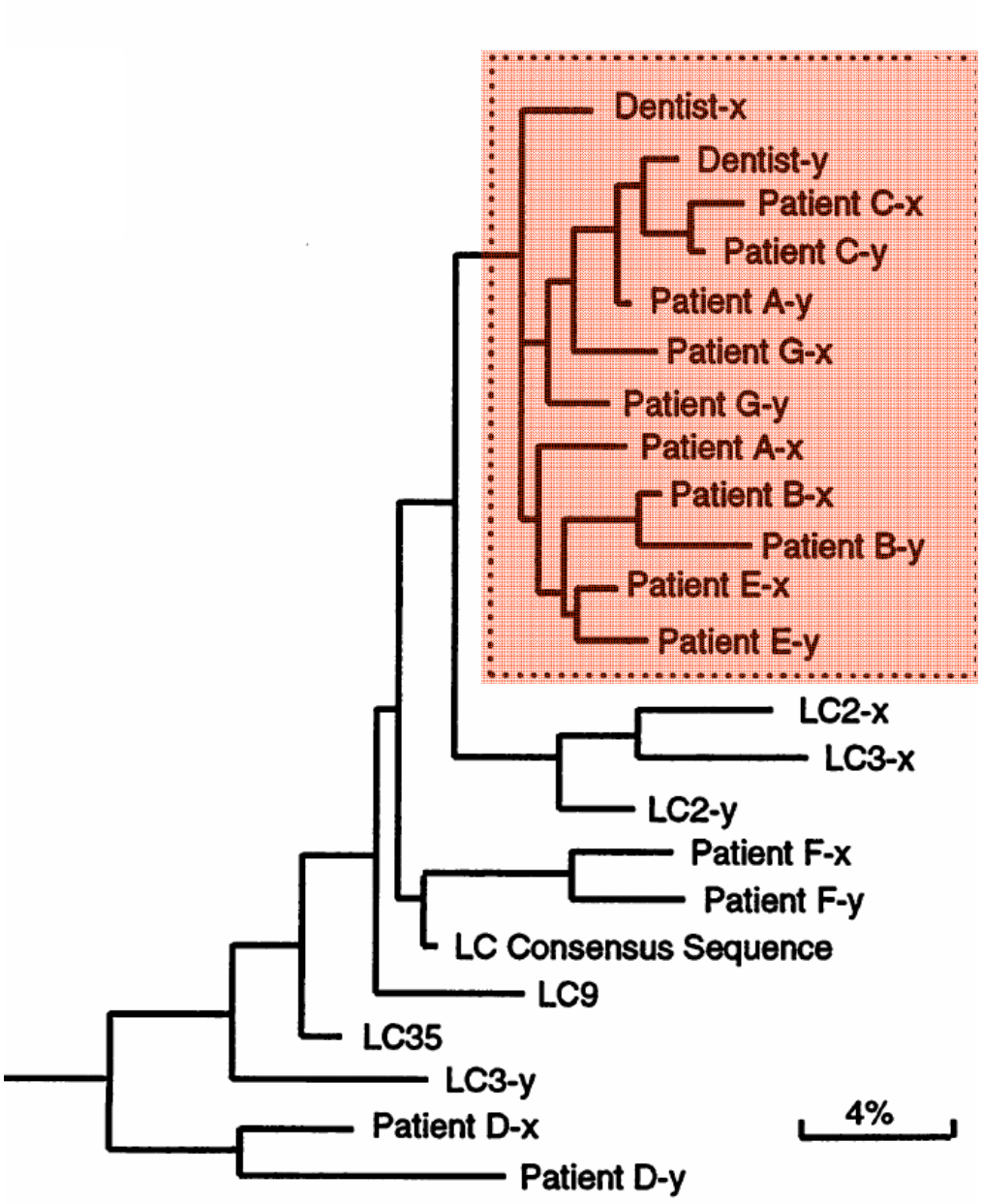
Transmission from HCW to patients

Transmission of HIV in a dental practice – Florida US



Ann Intern Med. 1992 May 15;116(10):798-805.

Transmission of HIV in a dental practice – Florida US



Dentist and 5 dental patients were closely related

Sequence of a portions of the HIV proviral envelope gene

Science. 1992 May 22;256(5060):1165-71.

Transmission of HIV from HCW to patients

Of 22,171 patients tested

Treated by 51 HIV+ HCW

113 (0.5%) patients became HIV+

Epidemiology follow up did not implicate HCW as the source of infection

CDC data

Ann Intern Med. 1995 May 1;122(9):653-7.

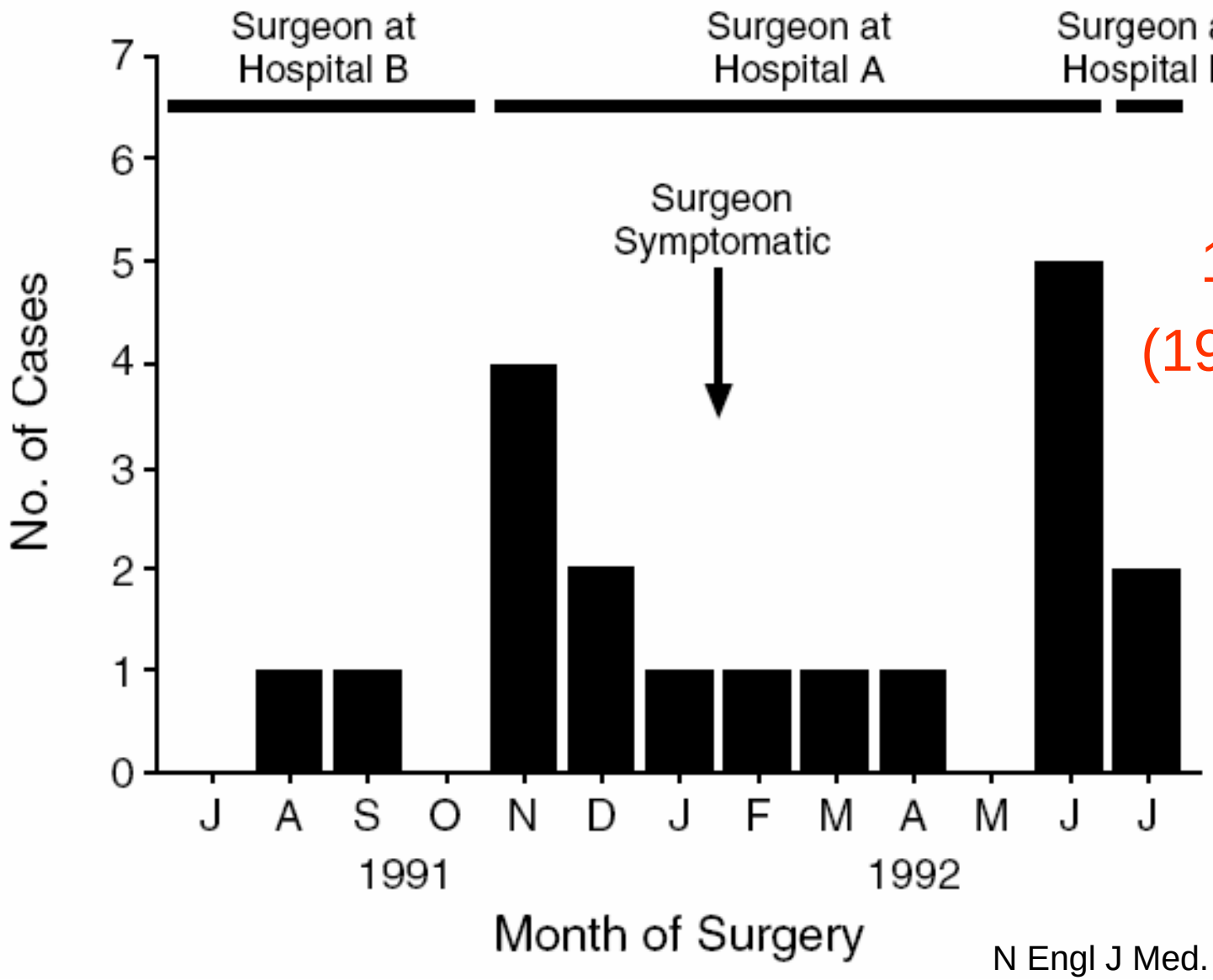
Probable Transmission of HIV from an Orthopedic Surgeon to a Patient in France (F/74)

Florence Lot, MD; Jean-Christophe Séguier, MD; Sophie Fégueux, MD; Pascal Astagneau, MD, PhD; Philippe Simon, MD; Michèle Aggoune; Patrice van Amerongen, MD; Martine Ruch, MD; Mireille Cheron, MD; Gilles Brücker, MD; Jean-Claude Desenclos, MD; and Jacques Drucker, MD, MSc

Ann Intern Med. 1999 Jan 5;130(1):1-6.

TRANSMISSION OF HEPATITIS B VIRUS TO MULTIPLE PATIENTS FROM A SURGEON WITHOUT EVIDENCE OF INADEQUATE INFECTION CONTROL

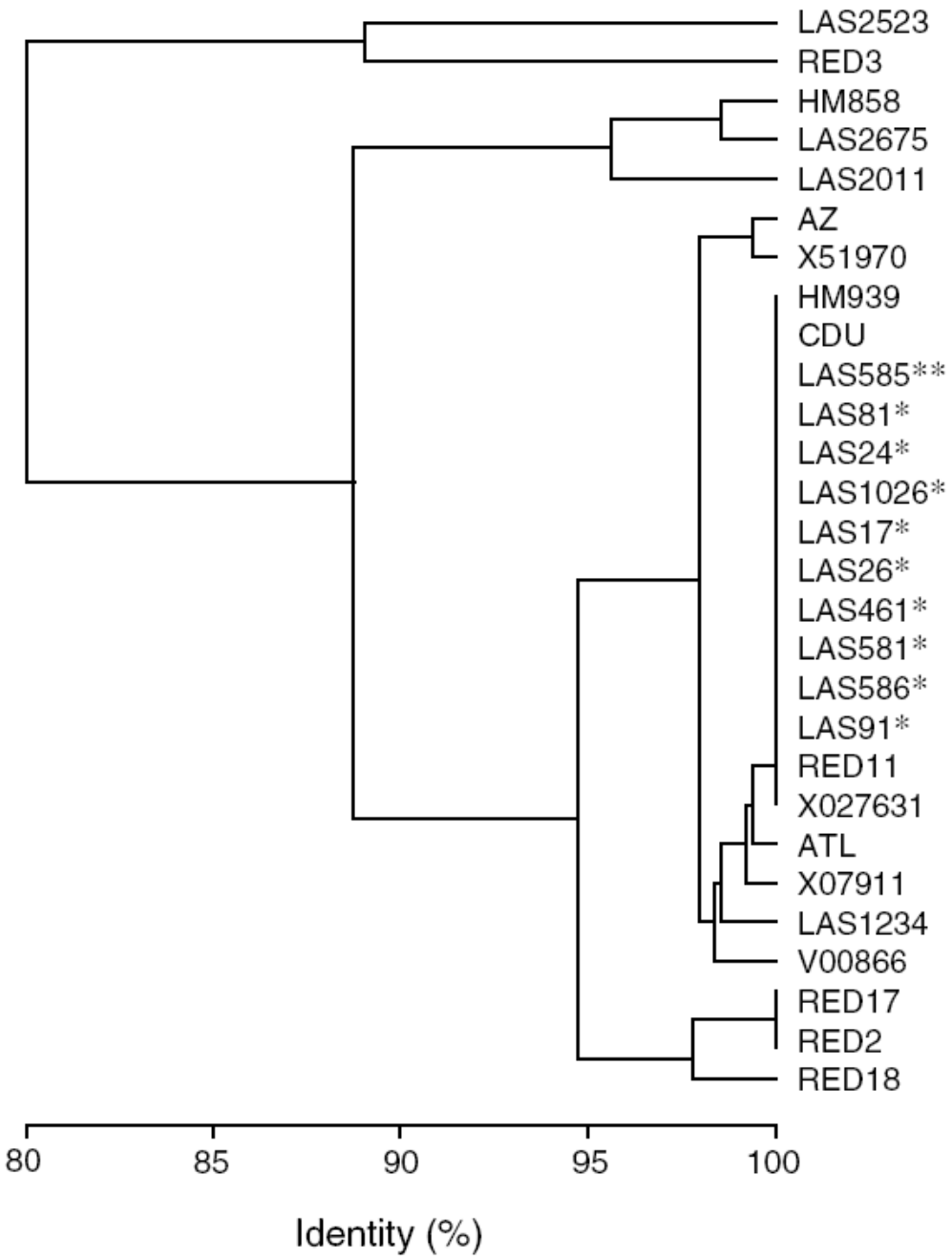
Thoracic surgeon: acute hepatitis B infection (HBeAg +ve)



13% infected

(19 of 144 patients)

N Engl J Med. 1996 Feb 29;334(9):549-54.



Sequence of 160 bases in the core region

Infected surgeon

9 Infected patients

N Engl J Med. 1996 Feb 29;334(9):549-54.

TRANSMISSION OF HEPATITIS B TO PATIENTS FROM FOUR INFECTED SURGEONS WITHOUT HEPATITIS B e ANTIGEN

4 surgeons ⟶ 4 patients

CHARACTERISTICS OF THE FOUR INDEX PATIENTS WHOSE HBV INFECTIONS WERE ASSOCIATED WITH CONTACT WITH HBV-INFECTED SURGEONS.

CHARACTERISTIC	PATIENT 1	PATIENT 2	PATIENT 3	PATIENT 4
Sex	F	F	F	F
Age group (yr)	30–39	30–39	60–69	70–79
Date of onset of jaundice	June 1988	October 1993	August 1994	January 1995
HBV subtype	ayw	adw	ayw	ayw
Type of procedure	Elective cholecystectomy	Elective cesarean section	Elective hysterectomy and removal of ovarian cyst	Elective cholecystectomy and nephrectomy
Interval between procedure and onset of jaundice (wk)	12	11	12	12
Blood transfusion	No	No	No	No
Sexual partner tested for HBV markers	Not tested	Anti-HBc–negative*	Anti-HBc–negative*	Not applicable
Other identified risk factors for HBV	None known	No	No	No
Identified source†	Surgeon 1	Surgeon 2	Surgeon 3	Surgeon 4
Role of infected surgeon in procedure	Main operator	Main operator	Assistant	Assistant

*Anti-HBc denotes antibodies against hepatitis B core antigen.

†All other members of the surgical teams were either immune to HBV or uninfected.

N Engl J Med. 1997 Jan 16;336(3):178-84.

CHARACTERISTICS OF THE HBV-INFECTED SURGEONS ASSOCIATED WITH THE TRANSMISSION OF HBV TO PATIENTS.

CHARACTERISTIC	SURGEON 1	SURGEON 2	SURGEON 3	SURGEON 4
Sex	M	M	M	M
Specialty	General surgery	Obstetrics–gynecology	Obstetrics–gynecology	General surgery,* urology
Professional level	Senior surgeon	Trainee	Trainee	Clinical assistant
Region of birth	Europe	Southeast Asia	Sub-Saharan Africa	Indian subcontinent
HBV subtype	ayw	adw	ayw	ayw
Year HBV status first recognized	1988	1993	1989	1995
Reason for HBV testing	Investigation of infection in Patient 1	Investigation of infection in Patient 2	Routine medical check	Investigation of infection in Patient 4
Result of HBeAg test†	Negative	Negative	Negative	Negative
Result of anti-HBe test†	Positive	Positive	Negative	Positive
HBV DNA‡				
Abbott Genostics assay (pg/ml)	70	Not detectable	Not detectable	Not done
Digene assay (pg/ml)	145	Not detectable	Not detectable	Not detectable
In-house assay (detectable copies/ml)	1×10^7	4.4×10^6	5.5×10^6	2.5×10^5
HBsAg titer by reverse passive hemagglutination	>1:8000	1:200	1:800	1:32
Dane particles in serum on electron microscopy	No (HBsAg particles seen)	Not determined	Not determined	Not determined
Years of surgical experience at time transmission recognized	>20	<1	5	>15
Previous hepatitis B vaccine	No	Yes	No	Yes
Occupationally acquired infection	Probable	No	No	No
History of reported needle-stick injury	No	No	No	No
Double-gloving practice	Not known	Occasional	Occasional	Occasional
Surgeon aware of HBV status at time of transmission	No	No	Yes	No
Technical expertise as assessed by colleagues	Competent	Competent	Competent	Competent

Published HBV transmissions from infected HCWs to patients

Author	HCW's profession	Published transmission rate[a]	HBV DNA (g Eq./ml)
Harpaz et al. (1996)	Thoracic surgeon	13.1%	1.0×10^9
The Incident Investigation Teams (1997)	(1) General surgeon	N.A.[c]	1.0×10^7
	(2) Gynaecologist	3.22%	4.4×10^6
	(3) Gynaecologist	0.90%	5.5×10^6
	(4) General surgeon	4.76%	2.5×10^5
Molyneaux et al. (2000)	Surgeon	1.6%	1.03×10^6
Spijkerman et al. (2002)	Surgeon	0.5–1.8%	5.0×10^9
Corden et al. (2003)	(1) Surgeon	N.A.	1.12×10^8
	(2) Surgeon	N.A.	2.55×10^5
	(3) Surgeon	N.A.	6.72×10^5
	(4) Surgeon	N.A.	6.35×10^4
	(5) Surgeon	N.A.	4.20×10^8
	(6) Surgeon	N.A.	9.47×10^8

Antiviral Res. 2003 Oct;60(2):79-85.

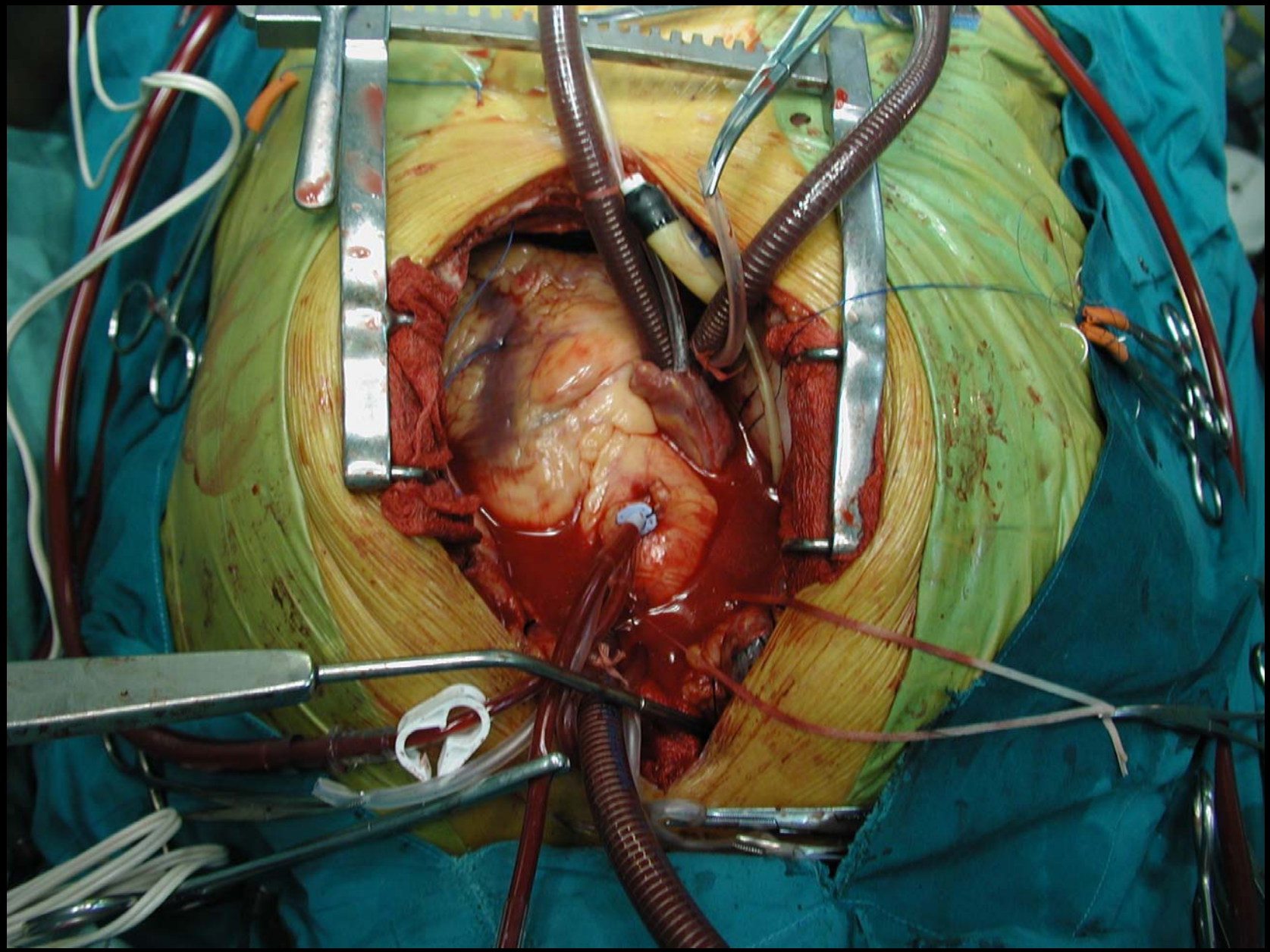
Published HCV transmissions from infected HCWs to patients

HCW	Year (country)	Number of patients infected	RNA level	Genotype	Risk factor
Cardiac surgeon	1988–1993 (Spain)	5	2.2×10^6 genome equivalents/ml	3	IVDU
Cardiac surgeon	1994 (UK)	1	10^6 genome equivalents/ml	4a	EPP
Anaesthesiologist	1994 (US)	1	3.7×10^6 genome equivalents/ml	1a	Probable IVDU
Anaesthesiology assistant	1998 (Germany)	5	1×10^6 copies/ml	1a	Failure to use standard precautions
Orthopaedic surgeon	2000 (Germany)	1	1.3×10^6 IU/ml	2b	EPP
Gynaecologist	2000 (Germany)	1	2.6×10^5 IU/ml	1b	EPP
Surgeon[a]	2000–? (UK)	1	/	2b	EPP
Gynaecologist[a]	1978–1999 (UK)	4	/	4	EPP
Member of surgical team[a]	1994–1999 (UK)	2	/	1b	EPP
Cardiac surgeon[a]	1993–1994 (UK)	1	/	?	?
Cardiac surgeon[a]	? (US)	3	/	1b	?
Operating room technician[a]	1991–1992 (US)	40	/	?	IVDU
Anaesthetist	? (Spain)	~217	/	?	IVDU

[a] The investigation into these transmission cases has yet to be published in detail.

J Clin Virol. 2003 Aug;27(3):213-30.

Exposure prone procedure



Courtesy of Dr WH Chui,
Cardiothoracic surgeon, GH

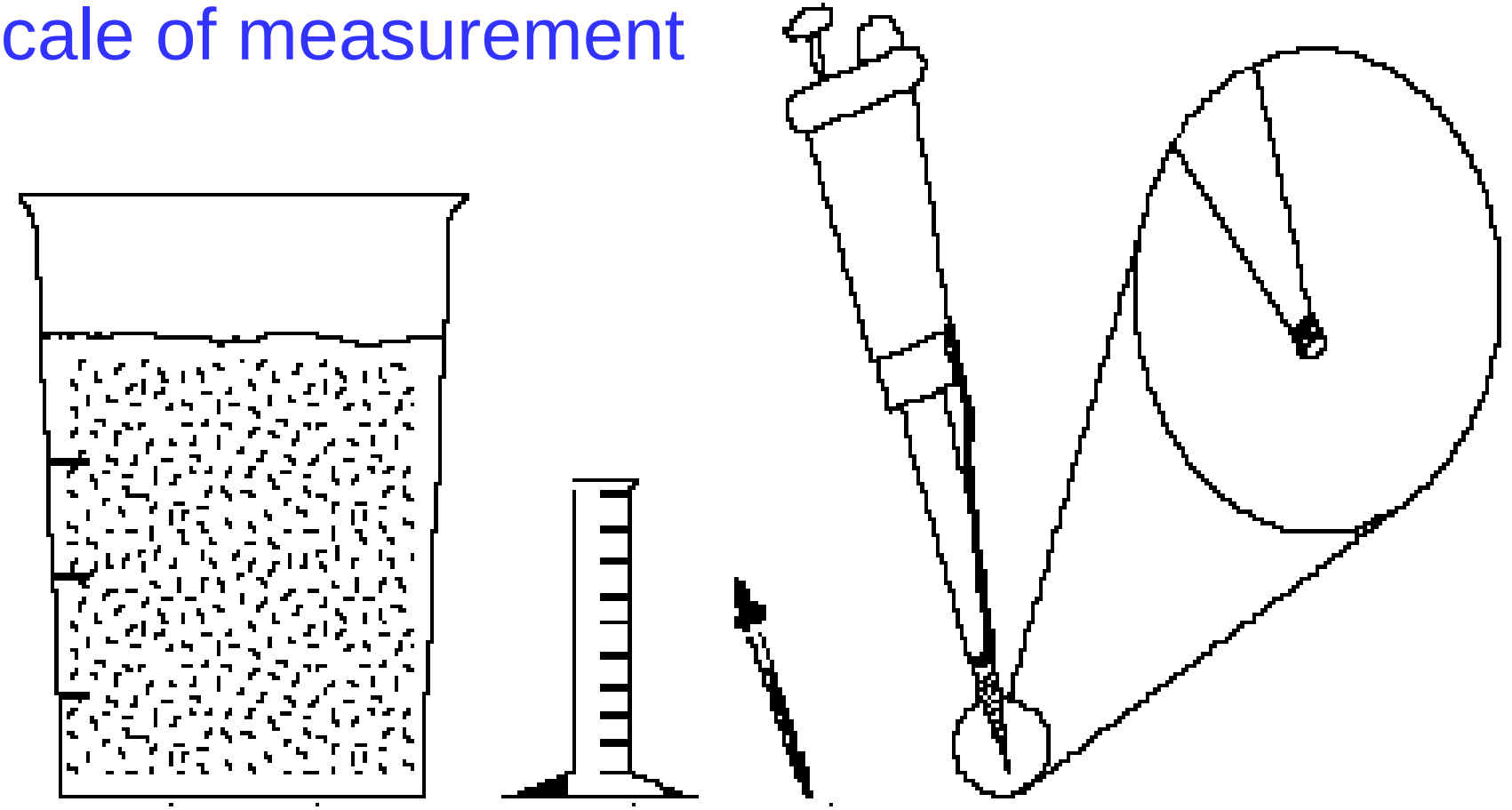
Calculation of HBV transmission from surgeon to patient during operative procedure

Maternal – fetal transfusion during delivery

< 1 µl of maternal whole blood

Antiviral Res. 2003 Oct;60(2):79-85.

Scale of measurement



1 L = 1000 ml	10 ml	1 ml	0.001 ml
1,000,000 µl	10,000 µl	1000 µl	1 µl

Calculation of HBV transmission from surgeon to patient during operative procedure

Maternal – fetal transfusion during delivery

< 1 μl of maternal whole blood

Maternal viral load in serum	10^2 gEq/ml	10^3 gEq/ml	10^4 gEq/ml	10^5 gEq/ml	10^6 gEq/ml
Viral particle per 1 μl serum	< 1	1	10	100	1000
Infectious viral particle per 1 μl	< 1	< 1	1	10	100
	Serum	(About 10% of HBV particles is infectious)			

Antiviral Res. 2003 Oct;60(2):79-85.

Calculation of HBV transmission from surgeon to patient during operative procedure

Maternal – fetal transfusion during delivery

< 1 μl of maternal whole blood

Maternal viral load in serum	10^2 gEq/ml	10^3 gEq/ml	10^4 gEq/ml	10^5 gEq/ml	10^6 gEq/ml
Viral particle per 1 μl serum	< 1	1	10	100	1000
Infectious viral particle per 1 μl	< 1	< 1	1	10	100
	Serum (About 10% of HBV particles is infectious)				
	< 1	< 1	< 1	6	64
	(a factor of 0.64 to calculate the vol of serum in whole blood)				

Antiviral Res. 2003 Oct;60(2):79-85.

Quantify inoculation volume delivered by suture needlestick injury

J Am Coll Surg. 2008 Jan;206(1):113-22.

Estimating volume of blood inoculated using a suture needle

< 1 µl of whole blood

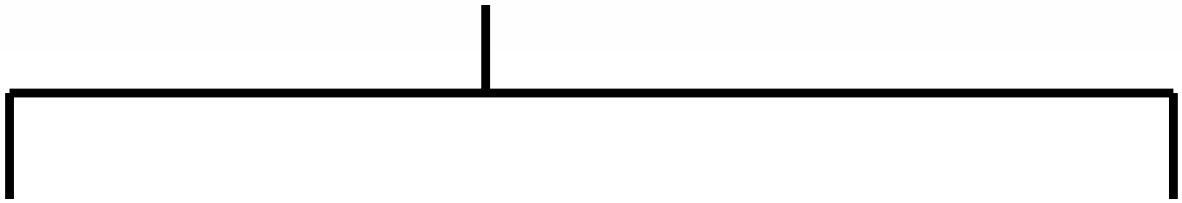
Estimating volume of blood inoculated using a suture needle

< 1 µl of whole blood

Surgeon viral load in serum	10^2 gEq/ml	10^3 gEq/ml	10^4 gEq/ml	10^5 gEq/ml	10^6 gEq/ml
Viral particle per 1 µl serum	< 1	1	10	100	1000
Infectious viral particle per 1 µl					
Serum	< 1	< 1	1	10	100
Whole blood	< 1	< 1	< 1	6	64

Antiviral Res. 2003 Oct;60(2):79-85.

Test for HBV DNA at designated lab



Baseline HBV DNA > 10^5 copies/ml

Restriction: performing EPP

Baseline HBV DNA: 10^3 to 10^5 copies/ml

(HBeAg negative)

Allow to perform EPP if

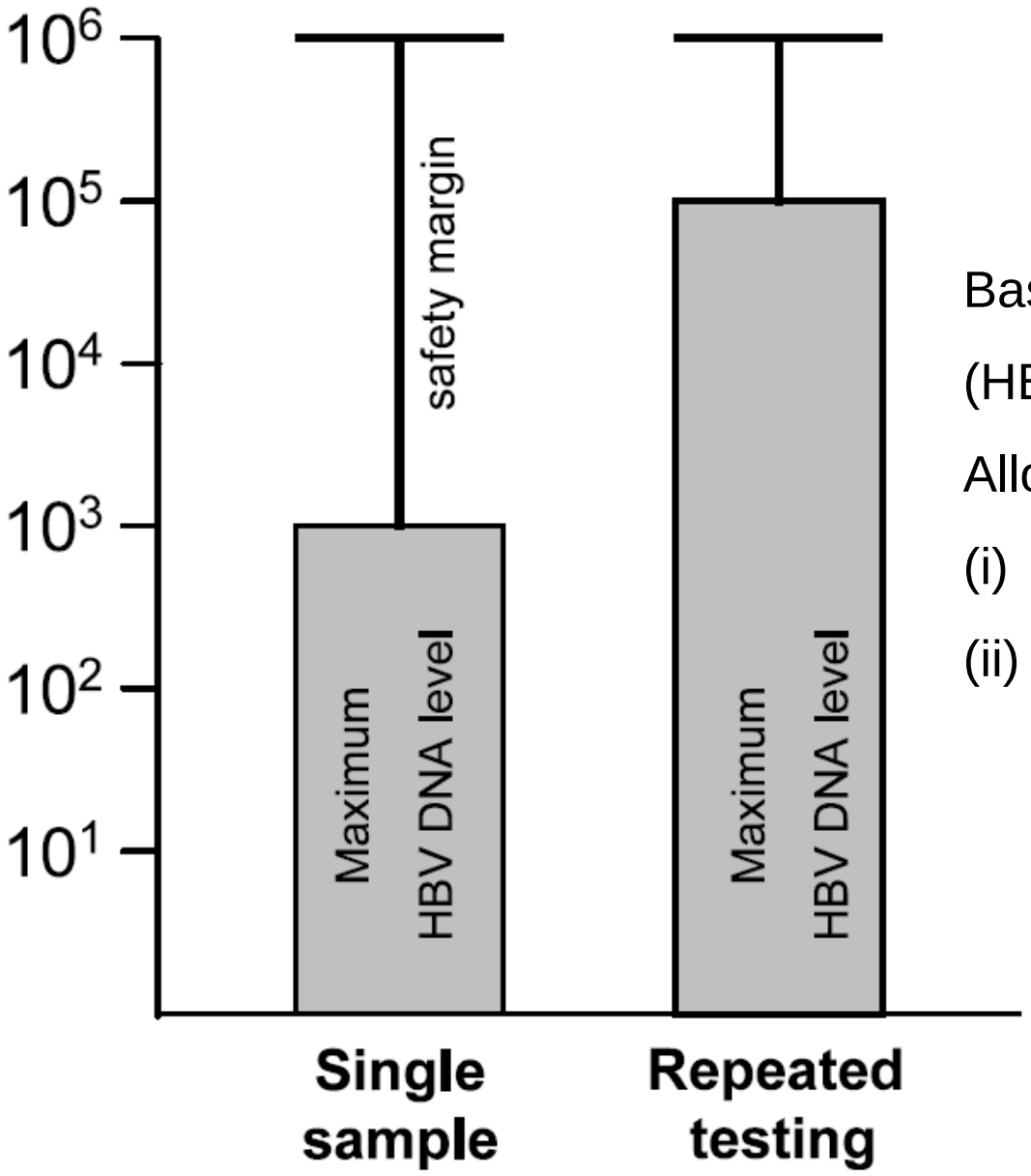
(i) on oral antiviral treatment

(ii) HBV DNA < 10^3 copies/ml

2007 (revised)

Hepatitis B infected healthcare workers and antiviral therapy

http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_073164



Baseline HBV DNA: 10^3 to 10^5 copies/ml

(HBeAg negative)

Allow to perform EPP if

(i) on oral antiviral treatment

(ii) HBV DNA < 10^3 copies/ml

J Clin Virol. 2003 Aug;27(3):231-4.

New HCW who will perform EPP

Non infectious for HBV:

HBsAg -ve OR HBsAg +ve (HBeAg -ve & HBV DNA < 10^3 copies/m)

Non infectious for HCV :

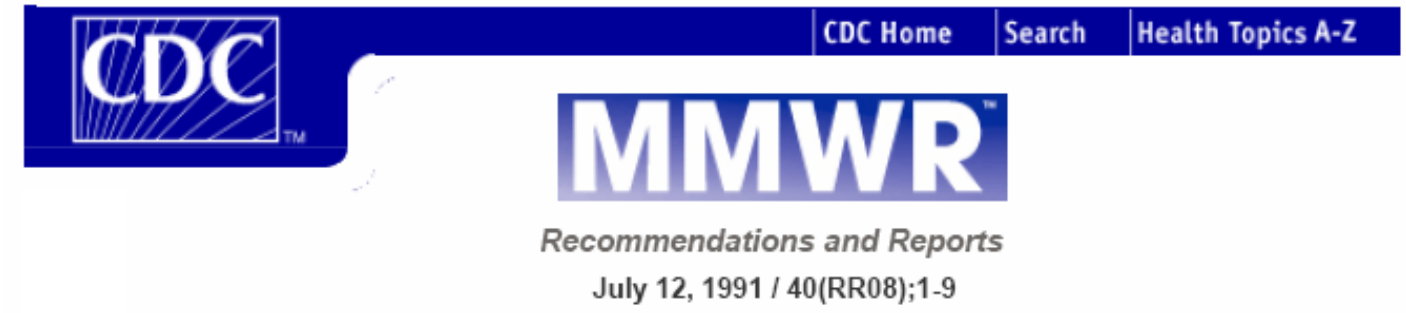
HCV Ab -ve OR HCV Ab +ve (HCV RNA -ve)

Non infectious for HIV (HIV Ab -ve)

2007

Health clearance for tuberculosis, hepatitis B, hepatitis C and HIV: New healthcare workers

http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_073132



Recommendations for Preventing Transmission of HIV & HBV to Patients During Exposure-Prone Invasive Procedures

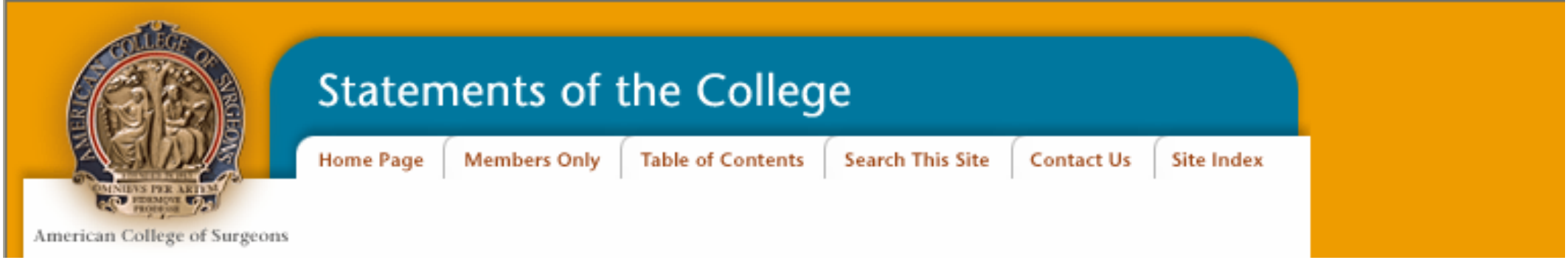
HCWs who are infected with HIV or HBV (HBeAg positive) should not perform EPP unless

(i) Consulted an expert review panel

(ii) Patients be informed of the HCW's seropositivity before procedure

No specific recommendation for HCV

MMWR Recomm Rep. 1991;40(RR-08):1-9.



(Revised May 2004)

HIV-infected surgeons may continue to perform EPP unless:

(i) Clear evidence that a significant risk of transmission of infection exists

(ii) Surgeon is functionally unable to care for patients

http://www.facs.org/fellows_info/statements/st-13.html

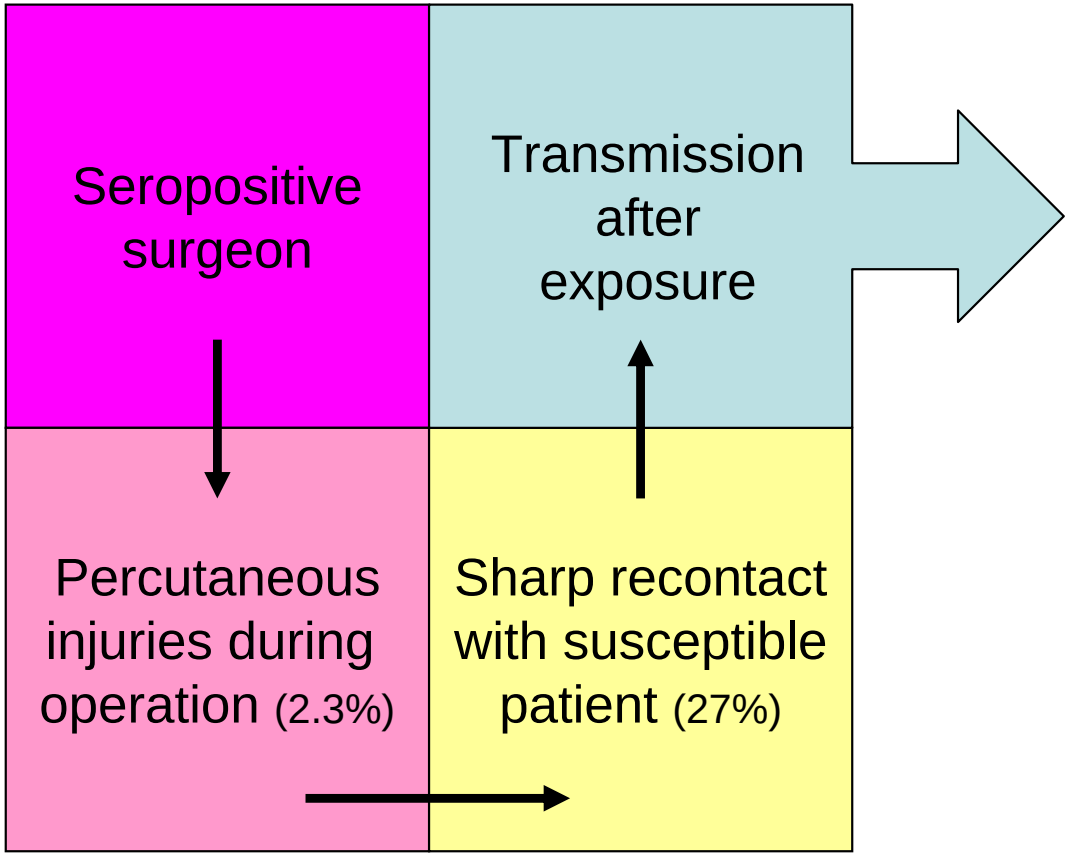
(Revised April 2004)

HBV - infected surgeon (HBeAg +ve or high HBV DNA): refer expert panel

HCV - infected surgeon: no reason to alter their practice

http://www.facs.org/fellows_info/statements/st-22.html

Model-based estimates of transmission from infected surgeons to patients

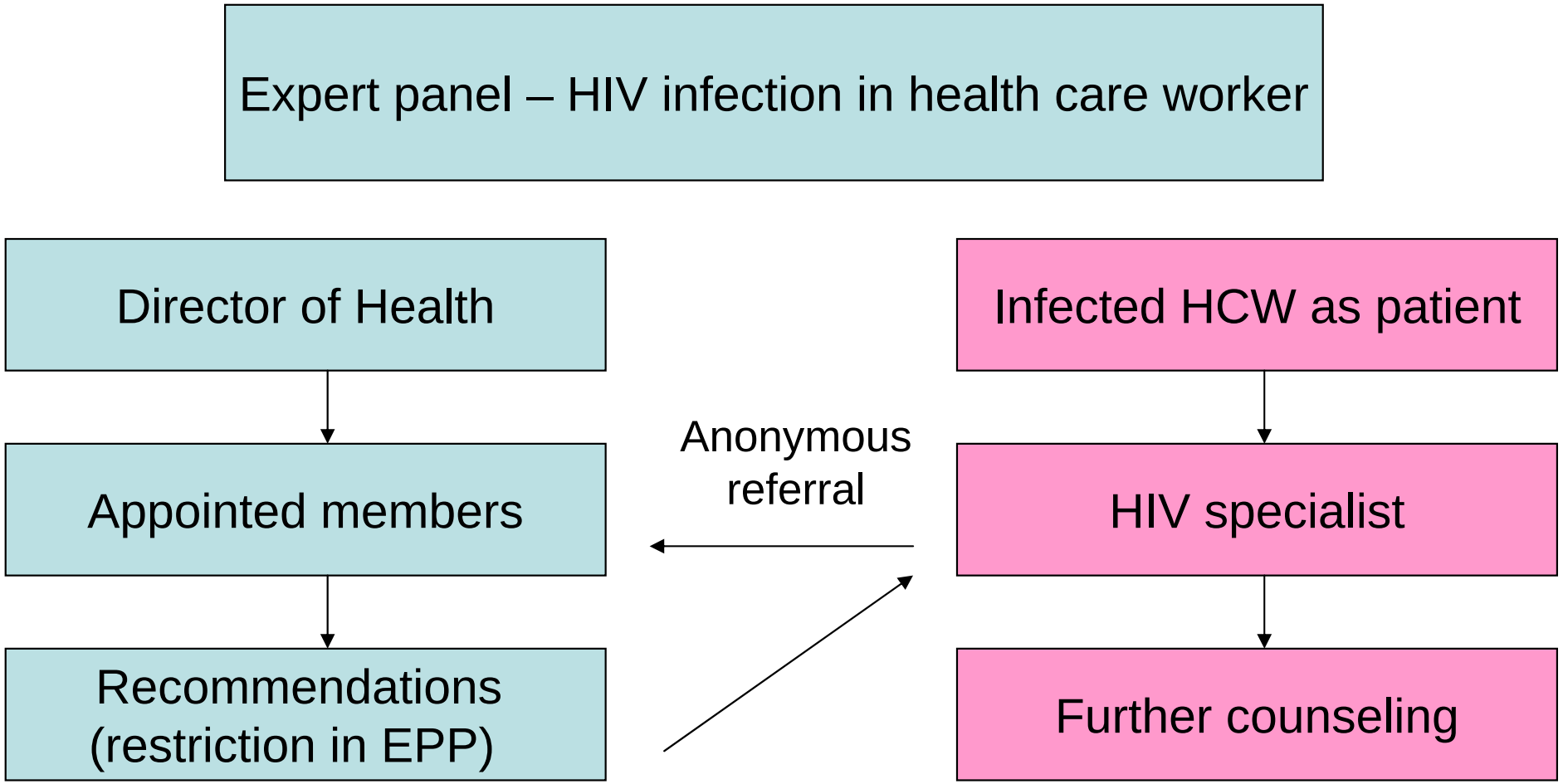


Risk of surgeon-to-patient infection per single procedure:

HIV	0.002%
HCV	0.01%
HBV	0.2%

Arch Intern Med. 2000 Aug 14-28;160(15):2313-6.

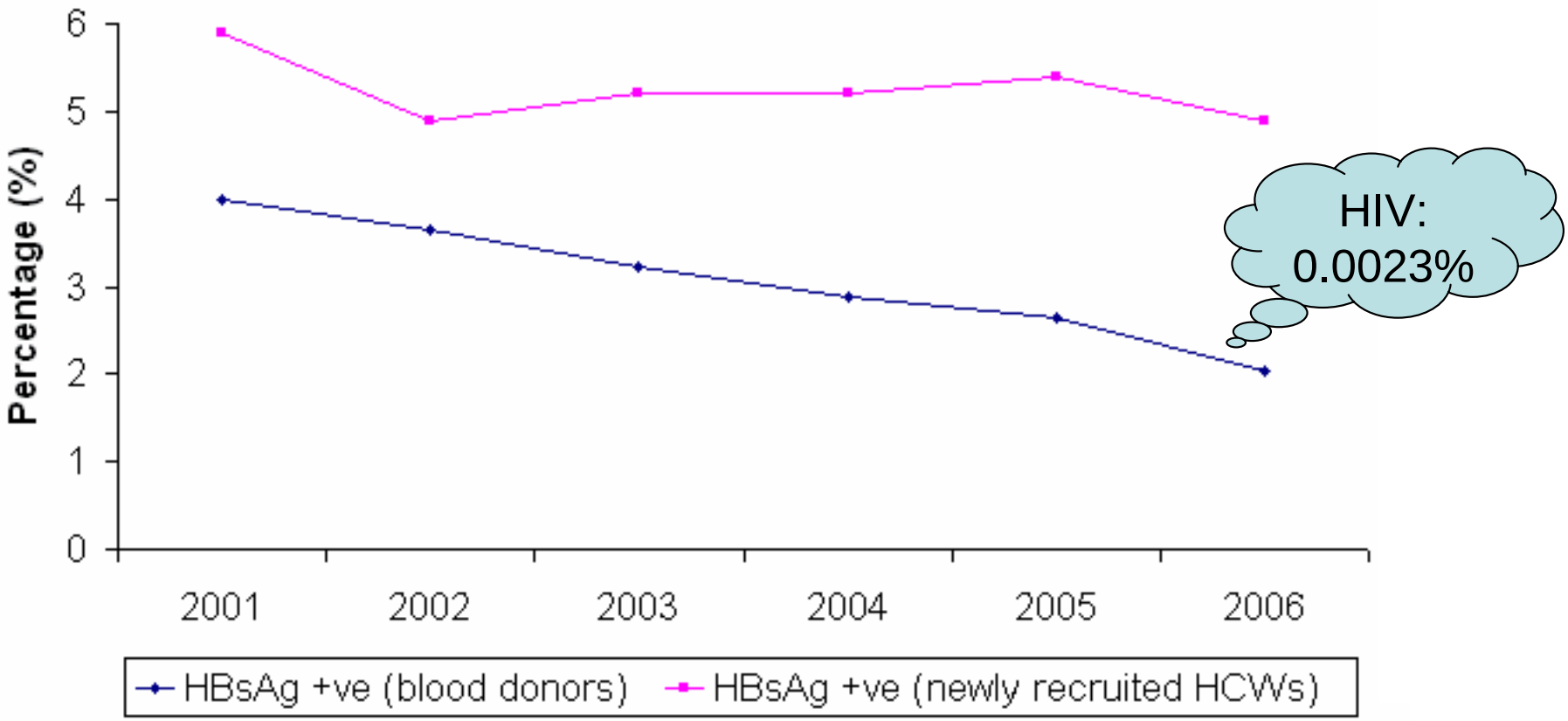
HIV infection and the health care workers
Recommended Guidelines in HK (1994)



Advisory council on AIDS, Dec 2003

Surveillance of Viral Hepatitis in Hong Kong - 2006 Update Report

Prevalence of hepatitis B carrier



Special Preventive Programme
Centre for Health Protection
Department of Health
December 2007

http://www.info.gov.hk/hepatitis/doc/hepsurv06.pdf

Vaccination of health care workers

Baseline — 1st dose

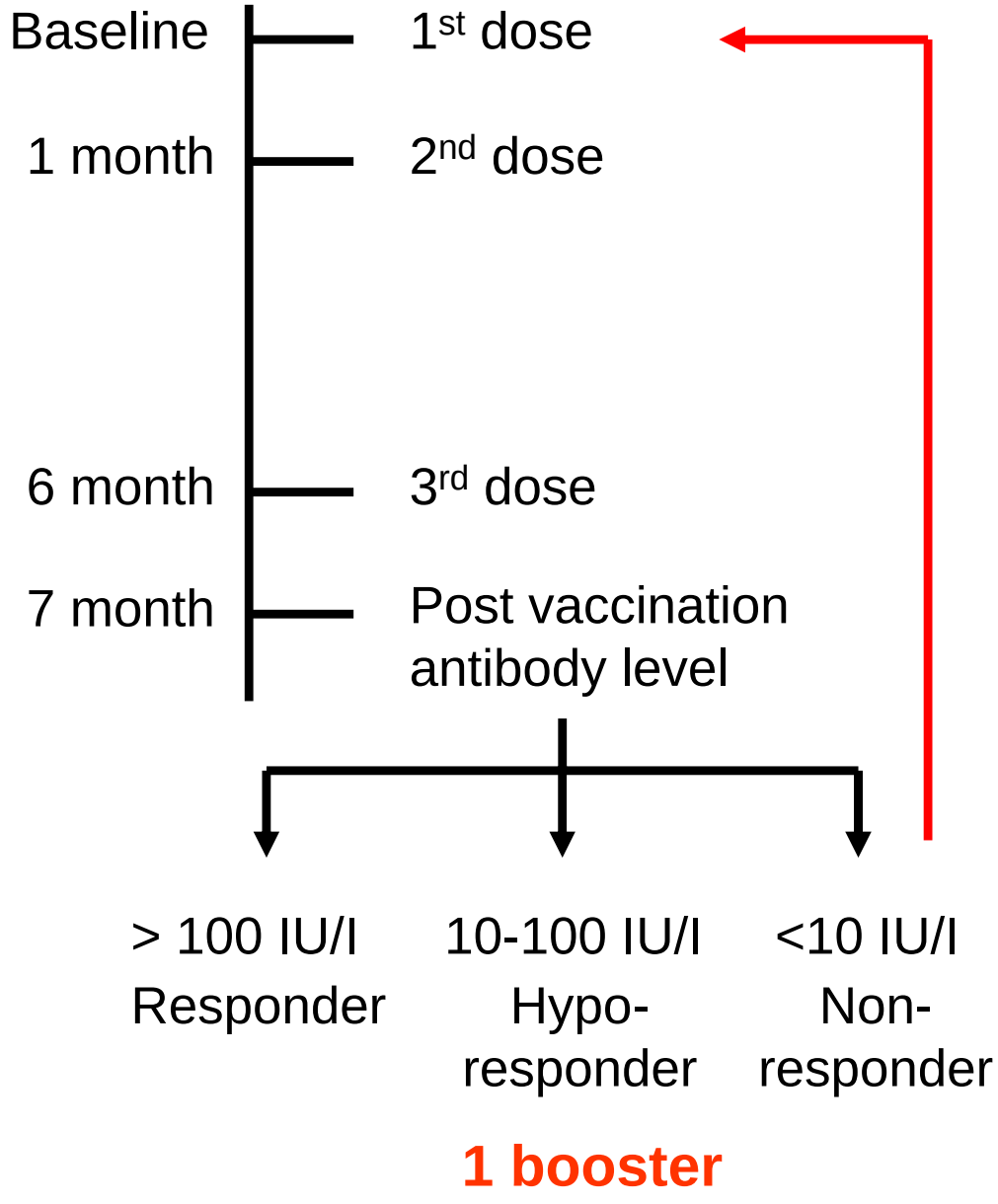
1 month — 2nd dose

6 month — 3rd dose

HBV vaccine is safe and efficacious (80-95%)

Vaccination of health care workers

HBV vaccine is safe and efficacious (80-95%)



Manpower by specialty in HA & Private HKSAR (2006)

Specialty
Accident & Emergency
Anaesthesia
Clinical Oncology
Ear, Nose, Throat
Family Medicine/OPD/Staff Clinic
Intensive Care Unit
Medicine
Neurosurgery
Obstetrics & Gynaecology
Ophthalmology
Orthopaedics & Traumatology
Paediatrics
Pathology
Psychiatry
Radiology
Surgery
Others - eg Hospital Mgt/HAHO, Dental
Grand Total

Private fellow

69

249

115

359

197

Dental surgeon

Surgical fellow
1597

HBV carrier (5%)
~ 80

HBeAg (33%)
~ 25

Source: HA website &
HK Academy Annual Report

中華人民共和國香港特別行政區政府
The Government of the Hong Kong Special Administrative Region of the People's Republic of China

CHP 衞生防護中心
Centre for Health Protection

醫院管理局
HOSPITAL AUTHORITY

Management of HBV-infected HCW in Hong Kong

Special program

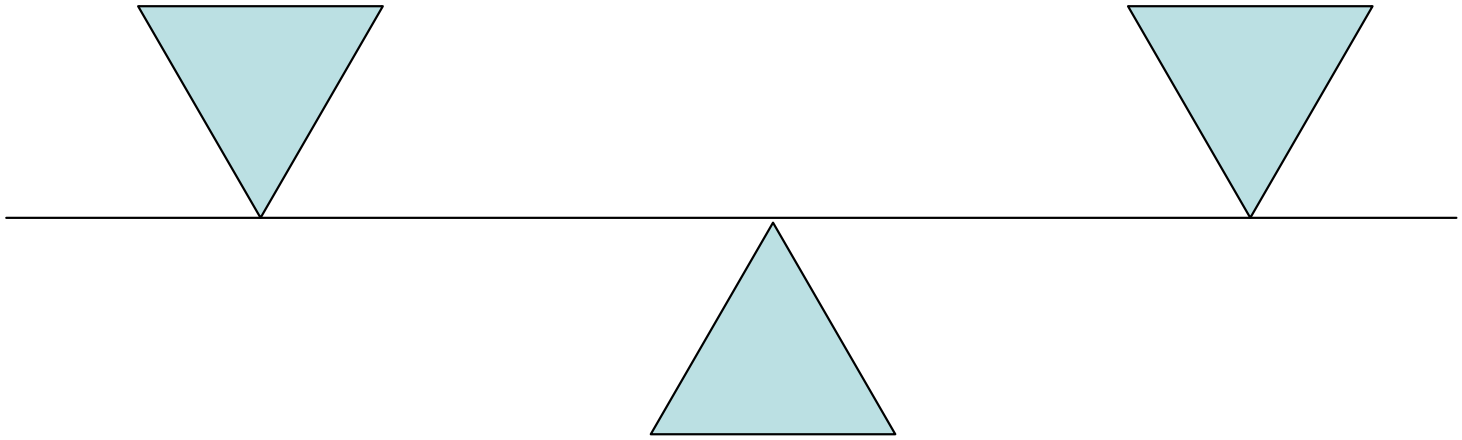
Encourage HCW (esp EPP) for voluntary testing for HBV (if not know)

Serostatus confidentiality

Viral load assay & antiviral therapy

Council concerning clinical duty

Patient safety




Thank you