A CLUSTER OF GROUP A STREPTOCOCCAL POSTOPERATIVE WOUND INFECTIONS

Objectives

Following this exercise, the student should be able to:

1. describe CDC, State, local, and hospital roles and relationships during an investigation;
2. describe the uses and limitations of numerator data;
3. describe sources and uses of data in a hospital-based investigation.

Part I

On August 12, 1980, the chairman of the infection control committee at a community hospital notified CDC of an outbreak of 7 cases of group A streptococcal (GAS) postoperative wound infections since April 23, 1980. Of the 7 patients with infections, 2 developed bacteremia, and 1 died.

QUESTION 1: What questions might you ask during telephone conversations with the chairman of the infection control committee regarding this suspected outbreak?

Further background information was obtained by telephone. The facility is a 300-bed private, community general hospital in Michigan which performs approximately 8,000 operations per year. The Infection Control Committee, composed of physicians, nursing supervisors, and administrators, is headed by an infectious disease subspecialist, who also voluntarily serves as the hospital epidemiologist. The infection control nurse (ICN) is responsible for routine surveillance and infection control. All reported infections are defined using clinical, epidemiologic, and bacteriologic criteria. Surveillance of discharged patients is not routinely performed. The infection control nurse has retained copies of all positive bacteriology laboratory reports since February 1980.

QUESTION 2: What factors might account for the apparent increase in Group A streptococcal surgical wound isolates?

QUESTION 3: Do you think there is a real outbreak? Is there sufficient evidence to continue the investigation?

On August 14, after discussions with other infection control personnel at the hospital and with a medical consultant from the Michigan Department of Public Health, CDC was invited to assist in an epidemiologic investigation. Accordingly, an EIS Officer departed for Michigan later that day.

QUESTION 4a: Place yourself in the role of the EIS Officer. With whom would you want to meet upon arrival in Michigan?

QUESTION 4b: What initial information and materials would you seek?

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Part II

The medical charts of the 7 patients identified by the Infection Control Committee as having group A streptococcal surgical wound infections (GAS-SWI) were requested. Meanwhile, bacteriology reports available from February 1 to August 15, 1980 and infection surveillance reports from January 1, 1979 to August 15, 1980 were reviewed for all group A streptococcus. Throat cultures were excluded from consideration. No group A strep was found except in surgical wound infections. Bacteriology reports prior to February, 1980 had been routinely discarded. Surveillance reports for December 1979 and January 1980 were not available.

In their surveillance reports, the Infection Control Committee defined 'surgical wound infection' as any postoperative wound with purulent drainage. Table 1 lists the monthly number of culture-positive surgical wound infections by organism, the number that were not cultured, and the total number of wound infections.

Table 1
Surgical Wound Infections, Hospital 'A', 1979-1980

Month	Cultured		Not cultured	Total
	Group A Strep	Other organism		
1979				
January	0	5	0	5
February	0	5	0	5
March	0	2	0	2
April	0	2	0	2
May	0	6	0	6
June	0	3	0	3
July	0	3	0	3
August	0	3	0	3
September	0	4	0	4
October	0	3	0	3
November	0	2	0	2
December	NA	NA	NA	NA
1980				
January	NA	NA	NA	NA
February	0	7	0	7
March	0	9	1	10
April	1	7	2	10
May	5	12	0	17
June	0	7	1	8
July	3	9	1	13
August	1	2	0	3

NA = not available

QUESTION 5a: Graph the information in Table 1.

QUESTION 5b: Interpret your graph. Do you think there is an outbreak?

QUESTION 6a: What rates might you want to examine to further evaluate this situation? What would you use as your denominator(s)?

QUESTION 6b: How would you go about obtaining these denominator data?

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Part III

The hospital microbiology laboratory presumptively identifies organisms as GAS if they are 1) beta-hemolytic on sheep blood agar, 2) sensitive to bacitracin, 3) CAMP-factor* negative, 4) inhibited by 6.5% NaCl broth, and 5) bile-esculin negative. These techniques were not changed during last two years.

Microbial susceptibilities are performed by the method of Kirby-Bauer.

Table 2 lists additional surveillance/laboratory data and denominator data.

TABLE 2
Surveillance/Laboratory and Denominator Data

Month	# Surgical Wound Infections		OR Procedures	Hospital Discharges	Surgical Wound Infection RATE	
	Total	Grp A Strep			Total	Grp A Strep
1979						
January	5	0	600	2950	_____	_____
February	5	0	590	2900	_____	_____
March	2	0	580	2750	_____	_____
April	2	0	560	2520	_____	_____
May	6	0	600	2700	_____	_____
June	3	0	530	2400	_____	_____
July	3	0	520	2450	_____	_____
August	3	0	490	2530	_____	_____
September	4	0	560	2690	_____	_____
October	3	0	580	2730	_____	_____
November	2	0	590	2860	_____	_____
December	NA	NA	500	2640	_____	_____
1980						
January	NA	NA	590	2970	_____	_____
February	7	0	600	2890	_____	_____
March	10	0	590	2710	_____	_____
April	10	1	620	2630	_____	_____
May	17	5	610	2720	_____	_____
June	8	0	540	2660	_____	_____
July	13	3	560	2610	_____	_____
Aug. 1-15	3	1	270	1340	_____	_____

* A substance produced by Group B Streptococci which enhances the beta-lysin production of Staphylococcus aureus.

QUESTION 7a: Calculate the monthly rate (per 1000) of all surgical wound infections and of Group A Streptococcal surgical wound infections. Graph your findings.

QUESTION 7b: Interpret these findings. Based on the information you have at this point, do you think an epidemic exists?

QUESTION 8: Review your answers to Question 2. Which of the explanations can be eliminated at this point?

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Part IV

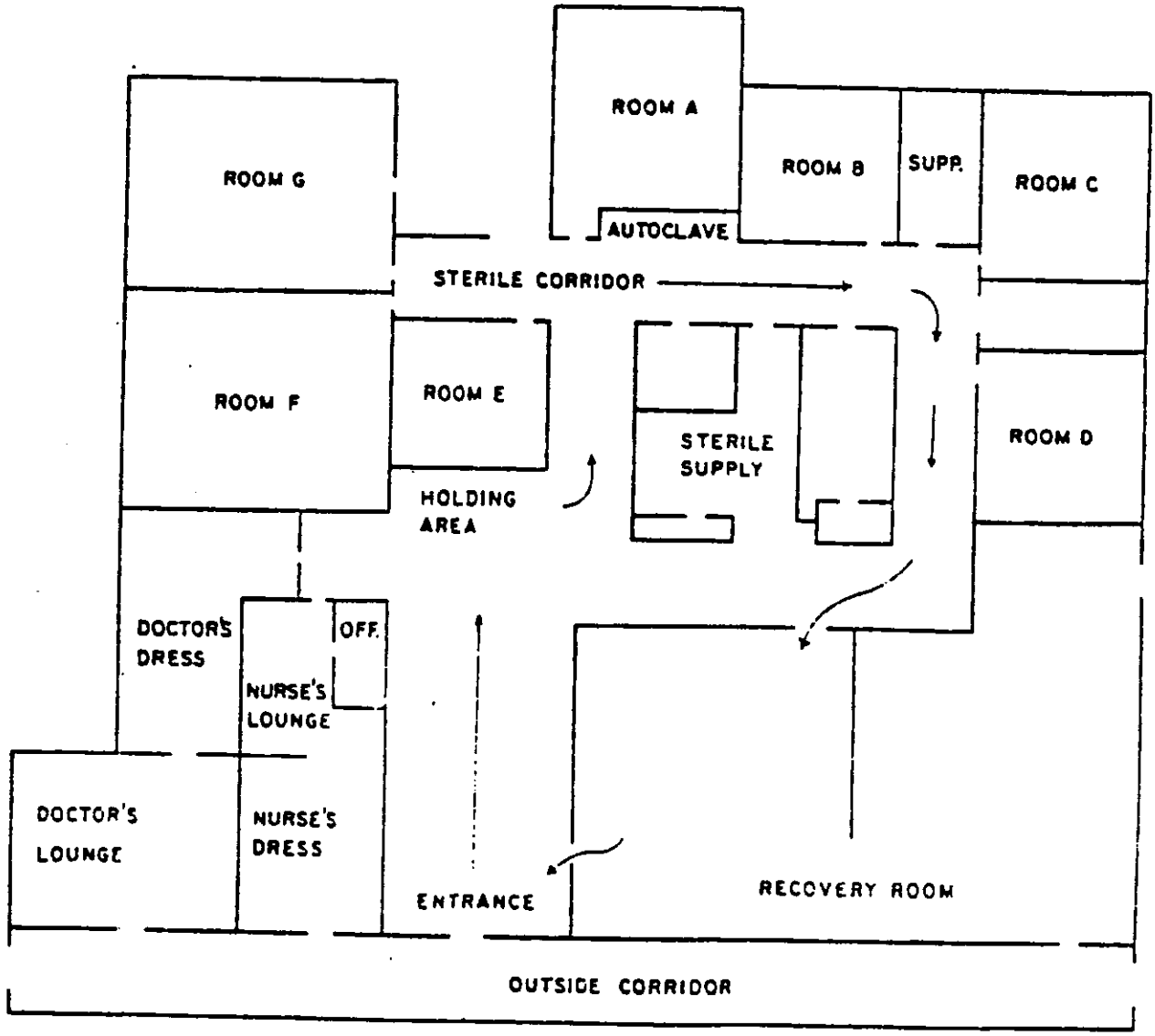
Surveillance and laboratory data were reviewed, and the EIS officer observed an increase in the rate of surgical wound infections caused by group A strep beginning in February-April 1980. An increase was also noted in the rate of surgical wound infection due to other organisms as well. The officer then learned that a new infection control nurse had been appointed in February 1980, and after collecting the appropriate denominators and calculating attack rates, the investigator concluded that an epidemic did exist.

In general, group A strep is an uncommon cause of surgical wound infection, has been isolated from fewer than 1% of all surgical-wound infections and causes fewer than two incisional-wound infections per 10,000 surgical patients. Transmission usually results from person-to-person contact, rarely by inanimate objects. Nasal carriers are particularly likely to transmit disease. In previous outbreaks, a member of the hospital staff has usually been shown to be a disseminator. Incubation period is short, usually 1-3 days.

The EIS officer also obtained a floor plan of the OR and information on the functioning of the surgical unit. Surgical patients are admitted to several wards in the hospital. Before surgery they are transferred to a holding area, then to the operating room, where they are shaved and prepped by the circulating nurse. The hospital has 7 operating rooms (ORs), A-G. With the exception of "E", which is a cystoscopy room, each OR is multi-purpose and is assigned for various procedures. During the investigation, OR personnel were interviewed and they complained that ventilation was poor and doors to these rooms were often left open. Several of the OR staff believed that OR "A" is the most likely source of infection. The plant engineer also stated that the ventilation equipment was found to be faulty in previous months. Also, the door to OR "A" is routinely left open during emergency procedures to facilitate telephone communication via the OR office. Postoperatively, patients are admitted to the recovery room where care is provided by a separate nursing staff. When stable, patients are returned to their original ward.

The EIS officer reviewed the charts of all patients identified by surveillance or lab records as having a group A strep surgical wound infection or non-cultured surgical wound infection, and made a preliminary line listing. After doing so, the EIS officer defined a case of group A strep surgical wound infection as a patient who postoperatively developed a temperature greater than 38.5°C and wound drainage that was culture-positive for group A strep. Medical records of the 10 patients who fit this case definition were then reviewed in further detail, and the line listing was refined.

QUESTION 9: What information from the medical records should be extracted and recorded on the line listing?


ROOM A
ROOM G
ROOM B
SUPP.
ROOM C
AUTOCLAVE
STERILE CORRIDOR
ROOM F
ROOM E
STERILE SUPPLY
ROOM D
HOLDING AREA
DOCTOR'S DRESS
OFF.
NURSE'S LOUNGE
DOCTOR'S LOUNGE
NURSE'S DRESS
ENTRANCE
RECOVERY ROOM
OUTSIDE CORRIDOR

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Part V

The line listing of the 10 cases are listed in Table 3.

QUESTION 10: What information can you derive from this listing?

TABLE 3

Characteristics of Cases

Case	Age	Sex	Ward	Type of Surgery	Date of Surgery	Operating Room	Parenteral Antibiotic Prophylaxis	Duration of Surgery (min)	Wound Drain	Fever 101 (hrs) after Surgery	Date of Wound Inflamm:	Culture Date	Culture Site
1.	46	F	5NW	TAH, BSO*	4/23	A	No	100	No	17	4/29	4/30	wound
2.	77	M	3C	cholecystectomy choledocholithectomy	5/2	F	No	150	Yes	32	5/4	5/6	wound
3.	47	M	5SW	laminectomy	5/6	G	No	120	Yes	24	5/9	5/9 5/8, 5/10	1)wound 2)blood
4.	55	F	3C	lobar resection & pleural stripping	5/8	D	No	120	Yes	17	5/12	5/16	wound
5.	84	F	2SE	pyelolithotomy	5/14	C	No	60	Yes	36	5/17	5/21 5/21,5/24	1)wound 2)blood
6.	55	M	3C	sigmoid resection	5/20	F	No	105	Yes	48	5/23	5/23	wound
7.	22	F	5SW	ORIFß- ankle	7/6	A	No	150	No	20	7/7	7/8	wound
8.	65	F	5SW	bunionectomy	7/21	F	No	45	No	18	7/23	7/23	wound
9.	40	F	4SW	melanoma resection with skin graft	7/21	A	No	145	Yes	99	7/25	7/25	wound
10.	37	F	5NW	TAH, BSO	7/30	A	No	105	No	32	8/1	8/4	wound

* Total abdominal hysterectomy, bilateral salpingo-oophorectomy

ß Open reduction, internal fixation

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Part VI

Streptococcus almost always has a human reservoir. The investigators were therefore interested primarily in exposures to infectious persons rather than to fomite or environmental exposures.

Surgical personnel include 31 surgeons, 6 surgical assistants, 26 nurses, 9 anesthesiologists and nurse anesthetists, 3 operating room technicians, and 2 housekeepers. In most operations, 1 circulating nurse and 1 scrub nurse assist the surgeon and the anesthetist. Generally, nurses work in only 1 operating room each day and are assigned to rooms according to the requirements of the schedule.

During the first week of August, before CDC's involvement, the hospital had obtained throat cultures from all operating room employees. Only the culture from Anesthetist E had been positive for Group A Streptococcus. He had been temporarily relieved from duty and treated with penicillin.

Table 4 lists relevant data from the operating suite log book for the 10 cases.

Question 11a: Evaluate these data.

Question 11b: What are your working hypotheses?

Question 12: How would you test your hypotheses?

Table 4
OPERATING ROOM and PERSONNEL EXPOSURE TO CASES

Patient	OR	Surgeon	Surgical Assistant	Anesthetist	Scrub Nurse	Circulating Nurse
1	A	E,K	-	E	e,f	F,G,I,K
2	F	F	b	C	d	I,J
3	G	B,L	-	A	f	I,L
4	D	A	a	A	b,c	D,I
5	C	C,I	-	B	b	D,E
6	F	D	a	D	f	I,J
7	A	G	-	A	-	D,I
8	F	G	-	E	d	I,M
9	A	F	c	D	g	J
10	A	H,J	-	B	a	D,I

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Part VII

The EIS officer decided to select controls from hospital surgical patients. A total of 2600 surgical procedures was performed during the outbreak period from which a control group of 80 procedures was randomly selected. Twenty-six of these 80 procedures were out-patient procedures for which surveillance data were not available; therefore, these patients were excluded from analysis. The names of all personnel involved in each operation were obtained from the operating room logbook for the 54 controls.

Table 5 lists data derived from the operating suite log book for the controls.

QUESTION 13: Construct 2-by-2 tables to analyze the data for OR 'A', nurse D, and nurse I. Calculate the appropriate measures of association.

QUESTION 14: What other studies might be undertaken to add weight to the epidemiologic evidence?

Table 5
OPERATING ROOM and PERSONNEL EXPOSURE TO CONTROLS
(54 controls)

Operating Room		Surgeon		Surgical Assistant		Anesthetist		Scrub Nurse		Circulating Nurse	
A	16	A	6	a	3	A	11	a	10	A	0
B	5	B	1	b	0	B	4	b	2	B	1
C	6	C	1	c	0	C	5	c	8	C	8
D	7	D	6	d	1	D	5	d	5	D	6
E	0	E	5	e	2	E	9	e	9	E	5
F	13	F	0	f	2	F	10	f	12	F	7
G	7	G	3			G	0	g	2	G	5
		H	1			H	10	h	5	H	7
		I	4			I	1	i	0	I	5
		J	3					j	0	J	6
		K	0					k	2	K	8
		L	2					l	1	L	12
		M	2							M	2
		N	2							N	0
		O	2								
		P	3								
		Q	7								
		R	5								
		S	1								
		T	2								
		U	4								
		V	2								
		W	6								
		X	2								
		Y	1								
		Z	1								
		AA	2								
		BB	1								
		CC	3								
		DD	1								
		EE	3								

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Part VIII - Conclusion

An additional case-control study was conducted to identify risk factors among patients exposed to nurse I and to determine the mode of transmission. For controls, the investigators used a random number table to select 50 surgical in-patients from the 286 who had exposure to nurse I during the epidemic period (excluding the 8 case-patients.) This case-control study identified several independent risk factors among nurse I's patients, including presence of skin incisions or traumatic wounds, lack of use of prophylactic antibiotics, and longer duration of surgery.

To determine if group A strep could have been transmitted by the airborne route, 12 blood agar plates were placed in an operating room during 2 operations on August 14. One of 6 settle plates placed in the corners of the operating room in which nurse I worked yielded group A strep. However, none of 6 settle plates from the operating room in which nurse I did not work yielded group A strep. In addition, 2 settle plates placed in an enclosed room (8 feet x 5 feet x 5 feet) in which nurse I exercised alone for 5 minutes were both positive for group A strep. Of the 25 cultures taken from nurse I's scalp, ear, nose, throat, areas between fingers and toes, subungual sites, umbilicus, anus, vagina, and perineum, the 3 from the anus, vagina, and perineum all yielded group A strep. The isolates from nurse I, from the various settle plates, and from the 2 patients with bacteremia were of the same serotype.

Nasopharyngeal, anal, vaginal, and perineal cultures from circulating nurse D and nasopharyngeal cultures of nurse I's husband and 2 children were also taken. No other culture yielded group A strep.

At the conclusion of the investigation the following recommendations were made:

1. Circulating nurse I should complete a course of parenteral penicillin therapy prescribed by her physician.
2. She should be removed temporarily from operating room duty. She could resume her duties when she no longer carries group A Streptococcus, as demonstrated by negative vaginal, perineal, and rectal cultures 1 and 7 days after completion of therapy.
3. Culture surveillance of nurse I should be performed weekly for the first month and then once every 3 months for 1 year to assure that she remains culture-negative.
4. The OR number for each surgical procedure should be written in the OR logbook and in the patient's chart.
5. Operating room doors should be closed at all times during operations.
6. Ventilation systems in the operating room should provide a minimum of 15 air changes per hour for all outdoor air systems, in accordance with the guidelines of the Health Resources Administration.
7. To facilitate epidemiologic investigation and surveillance of nosocomial infections, bacteriology culture records should be maintained for at least 3 years.