Appendices

Appendix A1: Hospital activity data

Appendix A1 Tables 1, 2 and 3 summarise several characteristics of the four public hospitals: annual hospital separations, average available beds, and (where available), number of surgical separations for the three sample periods in the ten years since 1988. Data were unavailable for 1988/89, so the limited available data for 1989/90 are reported. Table 4 reports the private hospital's data.

Appendix A1 Table 1: Summary of 1989/90 characteristics of the four public hospitals and their representativeness within New South Wales

NSW Acute Public Hospitals 1989/90	Hospital separations	Average available beds	Number of surgical separations
A1: Hospital D	49220	915	n/a
B1: Hospital E	18114	362	n/a
B2: Hospital A	9869	178	n/a
C1: Hospital B	6515	120	n/a
TOTAL	**83,718**	**1,575**	**n/a**
Study sites' separations as proportion of NSW acute public hospitals	**8.46%**	**6.93%**	**n/a**
Study sites' separations as proportion of A1, B1, B2 & C1 hospitals	**n/a**	**n/a**	**n/a**

Source: New South Wales Health Department (1990)

Appendix A1 Table 2: Summary of 1992/93 characteristics of the four public hospitals and their representativeness within New South Wales

NSW Acute Public Hospitals 1992/93	Hospital separations	Average available beds	Number of surgical separations
A1: Hospital D	56621	789	13687
B1: Hospital E	19206	303	4537
B2: Hospital A	9874	151	3332
C1: Hospital B	9183	112	1994
TOTAL	**94,884**	**1,355**	**23,550**
Study sites' separations as proportion of NSW acute public hospitals	**8.65%**	**7.66%**	**8.36%**
Study sites' separations as proportion of A1, B1, B2 & C1 hospitals	**12.31%**	**13.78%**	**11.31%**

Source: New South Wales Health (1994b)

Appendix A1 Table 3: Summary of 1997/98 characteristics of the four public hospitals and their representativeness within New South Wales

NSW Acute Public Hospitals 1997/98	Hospital separations	Average available beds	Number of surgical separations	Number of operating rooms	Number of endoscopy rooms
A1: Hospital D	55728	707	13876	16	3
B1: Hospital E	21735	303	4173	6	2
B2: Hospital A	13107	144	4155	3	1
C1: Hospital B	11616	144	2916	2	1
TOTAL	**102,186**	**1,298**	**25,120**		
Study sites' separations as proportion of NSW acute public hospitals	**8.46%**	**8.45%**	**8.77%**		
Study sites' separations as proportion of A1, B1, B2 & C1 hospitals	**10.36%**	**10.87%**	**10.81%**		

Source: New South Wales Health (1999b)

Appendix A1 Table 4: 1997/98 summary of characteristics of the private hospital

NSW Private Hospitals 1997/98	Hospital separations	Average available beds	Number of surgical separations	Number of operating rooms	Number of endoscopy rooms
Hospital C	4656	60	4556	2	1

Source: Hospital C internal monthly activity reports and *Operating Theatre Surgical Register*.

Appendix A2: Sample raw data – Intra-operative times from hospitals A, B and E

3 MONTHS	Open Cholecystectomy									Laparoscopic Cholecystectomy									
	A (1988)	A (1993)	A (1998)	B (1988)	B (1993)	B (1998)	E (1988)	E (1993)	E (1998)	A (1993)	A (1998)	B (1993)			B (1998)			E (1993)	E (1998)
Count	39	12	7	24	8	8	26	14	6	15	35	99			112			25	33
Average	91.41	102.08	134.28	83.33	81.87	69.13	89.69	122.14	149.17	137.67	112.29	77.27			65.21			114.44	102.64
StdDev	26.56	32.99	44.58	31.06	32.73	19.64	18.11	33.02	47.58	23.37	39.49	30.05			20.61			31.12	33.16
Maximum	165	170	200	200	140	98	125	190	205	190	245	155			145			201	180
Minimum	50	70	75	50	55	50	58	70	95	105	60	30			25			60	40
	105	80	180	70	55	75	67	190	185	170	105	90	60	30	95	49	75	117	80
	65	90	135	65	100	50	102	149	110	150	65	85	100	155	71	70	66	60	83
	75	115	130	70	115	50	95	160	205	140	95	80	120	75	53	60	75	115	58
	65	85	130	85	55	55	101	100	115	120	150	65	95	130	80	70	67	140	80
	55	80	75	110	60	65	125	70	185	115	105	105	45	80	52	95	65	122	95
	75	90	90	55	55	62	101	100	95	135	105	65	45	65	61	83	123	100	90
	95	110	200	90	140	98	73	105		130	160	75	40	55	111	55	45	134	120
	90	170		70	75	98	80	135		160	80	40	65	60	70	55	63	112	100
	70	85		90			77	148		105	105	90	130	85	58	44	113	110	110
	120	165		50			58	145		190	90	90	130	105	82	108	40	90	87
	115	85		110			90	110		120	95	95	90	70	41	57	85	170	135
	80	70		65			67	105		120	75	80	30	110	60	61	77	125	75
	70			75			89	84		120	90	40	50	105	95	65	43	95	95
	100			95			101	109		135	150	50	70	80	75	41	85	110	143
	135			50			115			155	120	85	110	50	65	60	47	160	95
	95			55			118				165	65	50		110	40	36	201	120
	70			105			118				125	50	125		145	63	44	95	146
	95			80			98				245	95	95		60	60	55	92	79
	165			60			83				115	95	120		58	67	45	115	130
	65			95			70				60	65	60		53	60	59	95	60
	95			200			80				80	45	45		55	70	77	142	40
	80			100			65				145	100	40		53	38	61	102	125
	115			65			95				80	80	85		42	54	50	77	147
	85			90			88				75	70	85		65	61	80	75	82
	90						101				105	50	100		56	50	57	107	78
	100						75				70	75	120		57	60	60		145
	155										115	50	120		27	70	76		50
	105										105	55	140		75	75	35		180
	150										110	85	85		98	72			150
	85										180	135	85		72	66			122
	95										110	50	130		85	100			70
	55										145	90	40		47	25			122
	50										165	40	45		52	67			95
	80										75	50	65		60	45			
	85										70	115	115		65	45			
	70											65	35		40	50			
	80											55	35		80	75			
	95											105	140		92	110			
	90											40	85		42	53			
												45	45		92	70			
												45	45		65	55			
												70	60		45	65			

	Colonoscopy																									
3 MONTHS	**A (1988)**		**A (1993)**		**A (1998)**				**B (1988)**	**B (1993)**	**B (1998)**	**E (1988)**			**E (1993)**						**E (1998)**				
Count	50		44		152				36	6	22	86			201						209				
Average	12.70		13.29		18.16				13.83	23.33	25.68	34.91			21.52						16.98				
StdDev	6.24		8.35		12.63				5.75	7.53	13.29	15.10			10.30						10.11				
Maximum	35		50		70				30	35	60	75			60						65				
Minimum	5		5		5				5	15	10	12			6						3				
	15	10	15	10	10	15	10	10	15	20	20	12	20	45	6	30	8	20	14	12	13	11	20	15	8
	20	20	20	50	15	50	20	10	15	15	43	24	45	36	7	26	18	10	17	8	27	40	13	10	21
	10	10	10		10	10	10	45	15	20	11	16	35		15	20	38	8	12	18	20	25	17	25	28
	15	20	10		20	10	20	30	20	35	28	25	20		9	14	24	16	35	12	16	25	8	9	4
	20	10	15		10	10	10	30	15	30	10	72	23		25	50	22	20	30	12	16	25	18	10	7
	10	15	15		15	20	10	20	10	20	15	56	14		50	13	36	20	8	21	9	31	12	5	22
	5	10	10		25	60	10	20	15		32	35	16		22	22	15	6	16	18	4	32	10	7	18
	5	20	30		15	15	10	10	10		20	30	26		24	50	20	14	23	10	16	23	9	28	15
	5		15		15	15	35	20	10		32	20	20		35	32		40	20	10	20	45	13	11	3
	10		20		40	5	20	20	5		43	70	24		11	25		24	34	23	36	33	9	6	52
	15		5		40	10	5	15	10		27	22	35		25	25		30	12	21	10	12	15	6	25
	10		25		30	30	5	45	5		15	35	15		45	40		12	17	14	21	20	10	6	27
	5		10		10	25	30	10	5		12	15	56		15	10		10	14	12	13	6	14	15	10
	5		5		20	5	5	10	15		23	48	34		23	18		8	16	20	33	12	14	18	12
	15		10		10	20	5	5	25		14	42	27		31	22		25	15	42	7	26	16	15	21
	10		10		20	20	10	15	15		20	70	20		30	38		12	12	27	17	16	5	18	20
	10		10		15	20	10	10	15		12	33	20		15	28		18	18	18	18	20	13	15	22
	10		10		10	10	20	40	5		60	47	52		15	20		18	22	50	8	20	23	25	12
	5		10		10	20	25	10	20		44	25	38		20	14		22	10	24	10	28	25	10	25
	15		10		20	10	30	10	13		32	28	30		20	34		50	20	16	23	20	3	20	7
	5		5		40	15	40	15	20		17	18	45		26	21		24	20	20	18	26	11	33	7
	15		15		10	5	15	10	20		35	18	30		45	20		16	8	45	29	10	13	15	26
	15		20		15	15	10	10	20			22	35		15	20		23	32	58	20	4	10	16	8
	10		5		20	5	5	15	15			30	28		20	25		12	19	12	27	28	12	13	7
	10		5		20	35	10	10	10			23	20		15	20		14	12	40	25	11	32	14	8
	15		10		10	15	20	10	10			27	40		11	35		31	28		13	7	20	18	10
	15		10		20	10	10		10			43	15		8	15		23	13		21	17	18	8	21
	10		15		20	5	10		20			25	75		11	15		14	12		12	11	5	12	17
	15		10		10	10	15		10			30	55		13	20		27	32		12	23	6	33	5
	5		30		10	10	35		20			35	45		15	35		20	16		6	10	8	23	6
	10		20		5	50	30		10			18	41		20	20		16	18		21	30	15	15	7
	15		10		10	10	70		10			34	55		30	15		18	9		35	25	23	45	10
	10		10		10	10	45		10			20	52		26	40		32	14		15	25	7	27	5
	10		20		10	15	10		30			42	43		35	20		12	26		15	10	4	14	16
	10		5		45	10	25		10			52	50		14	15		13	25		20	4	8	20	4
	5		10		65	10	25		15			32	45		20	20		24	60		17	5	15	16	10
	35		10		10	15	15					65	60		24	25		18	16		17	9	9	40	30
	30		5		5	10	50					30	25		16	14		18	16		38	41	30	32	9
	10		15		40	20	15					45	20		22	20		26	28		9	30	13	65	15
	20		10		20	20	10					60	40		30	10		20	24		21	7	9	52	10
	20		10		35	15	15					40	44		22	23		20	14		15	7	18	10	7
	15		10		20	10	15					32	22		25	12		37	36		16	12	13	9	

	D&C Hysteroscopy								Knee replacement					
3 MONTHS	**A (1998)**		**B (1998)**			**E (1993)**		**E (1998)**	**A (1988)**	**A (1993)**	**A (1998)**	**E (1988)**	**E (1993)**	**E (1998)**
Count	50		119			49		43	3	4	18	0	25	11
Average	25.600		25.496			29.449		18.116	121.667	130.000	153.889		135.200	102.364
StdDev	15.992		8.799			13.105		9.981	42.525	32.404	42.996		28.472	30.194
Maximum	95		58			61		40	170	160	260		185	155
Minimum	5		10			10		5	90	85	100		75	55
	95	20	40	26	22	36	22	20	170	85	190		100	90
	25	30	26	22	22	15	18	17	105	145	155		173	142
	15	45	12	42	30	20	61	10	90	130	115		143	120
	30	30	25	27	42	10	46	20		160	115		165	55
	35	20	37	25	51	25	49	10			140		105	65
	30	20	22	40	18	20	35	8			165		127	100
	20	15	26	23	42	47	40	18			140		170	94
	75	30	25	12	28	43		20			255		165	117
	20		25	20	24	50		17			125		126	105
	30		25	37	25	40		13			135		75	83
	20		21	27	21	20		10			150		131	155
	20		24	27	20	20		5			160		155	
	20		22	14	22	19		12			100		125	
	30		25	24	35	28		24			140		135	
	20		35	12	25	20		15			130		185	
	20		28	20	28	39		13			260		150	
	10		34	33	35	35		22			140		111	
	15		25	18	24	45		34			155		158	
	20		20	17	21	19		35					110	
	15		18	25	16	25		5					135	
	20		16	15	13	25		5					128	
	5		43	20	22	30		15					165	
	15		25	20	28	30		10					138	
	15		32	15	32	31		40					80	
	10		28	20	24	35		12					125	
	10		25	16	22	12		22						
	10		26	35	20	14		38						
	20		32	27	20	25		12						
	30		20	14	21	45		40						
	20		37	54	16	15		21						
	20		42	27	14	35		9						
	45		36	14	20	15		13						
	20		30	22	25	28		16						
	25		25	58	23	13		20						
	60		24	28	20	55		34						
	25		32	29		50		12						
	45		21	10		45		20						
	25		18	16		20		15						
	15		20	10		22		10						
	25		24	36		13		34						
	20		34	30		17		5						
	25		28	23		21		15						
								33						

Appendix A3: Quarterly procedure counts and operating minutes at each hospital

Appendix A3 Table 1: Procedure count for each sample quarterly period for the five hospitals

	TOTAL No. for all quarters & all hospitals	Hospital A B2: Major Non-Metropolitan			Hospital B C1: District Group 1			Hospital C Private Hospital			Hospital D A1: Principal Referral			Hospital E B1: Major Metropolitan		
		1988	1993	1998	1988	1993	1998	1988	1993	1998	1988	1993	1998	1988	1993	1998
Open Cholecystectomy	**299**	39	12	7	24	8	8	18	3	2	67	22	26	44	14	5
Laparoscopic Cholecystectomy	**478**	n/a	15	35	n/a	99	112	n/a	31	23	n/a	34	71	n/a	25	33
Colonoscopy	**2253**	50	44	152	36	6	22	96	230	233	296	246	346	86	201	209
D&C	**2078**	131	79	57	109	159	123	70	15	5	502	314	129	204	125	56
D&C Hysteroscopy	**531**	n/a	12	48	n/a	0	119	n/a	4	16	n/a	105	135	n/a	49	43
Total knee replacement	**107**	3	4	18	n/a	n/a	n/a	3	18	9	0	6	10	0	25	11
Total of selected procedures each sample period	**5746**	**223**	**166**	**317**	**169**	**272**	**384**	**187**	**301**	**288**	**865**	**727**	**717**	**334**	**439**	**357**
Total of all procedures in OS each sample period	**30345**	1180	1141	1512	794	918	1078	1082	1191	948	5350	5113	4957	1461	1941	1679
Sample procedure count as % of all case count	**18.94%**	18.90%	14.55%	20.97%	21.28%	29.63%	35.62%	17.28%	25.27%	30.38%	16.17%	14.22%	14.46%	22.86%	22.62%	21.26%

Appendix A3 Table 2: Operating minutes for each sample quarterly period for the five hospitals

	TOTAL for all quarters & all hospitals (minutes)	Hospital A B2: Major Non-Metropolitan			Hospital B C1: District Group 1			Hospital C Private Hospital			Hospital D A1: Principal Referral			Hospital E B1: Major Metropolitan		
		1988	1993	1998	1988	1993	1998	1988	1993	1998	1988	1993	1998	1988	1993	1998
Open Cholecystectomy	**31908**	3565	1225	940	2010	655	553	1109	325	120	8030	2785	3767	4219	1710	895
Laparoscopic Cholecystectomy	**45368**	n/a	2065	3930	n/a	7550	7360	n/a	2473	1761	n/a	4675	9306	n/a	2861	3387
Colonoscopy	**62933**	635	605	2760	498	140	565	2515	5508	5393	9794	8172	15778	2975	4235	3359
D&C	**27678**	1315	903	870	1547	2242	1637	738	170	61	8574	4570	2163	1530	938	420
D&C Hysteroscopy	**16643**	n/a	335	1280	n/a	n/a	3034	n/a	110	345	n/a	4446	4871	n/a	1443	779
Total knee replacement	**15541**	365	520	2770	n/a	n/a	n/a	449	2666	1400	0	1005	1860	0	3380	1126
Total operating minutes for selected procedures	**200070**	**5880**	**5653**	**12550**	**4055**	**10587**	**13149**	**4811**	**11252**	**9080**	**26398**	**25653**	**37745**	**8724**	**14567**	**9966**
Total operating minutes for all procedures in OS	**1822296**	47160	52285	73280	28142	37584	42202	44810	51071	39076	369868	384716	414448	63581	85921	88152
Sample operating minutes as % of all cases	**10.98%**	12.47%	10.81%	17.13%	14.41%	28.17%	31.16%	10.74%	22.03%	23.24%	7.14%	6.67%	9.11%	13.72%	16.95%	11.31%

Appendix A3 Table 3: Mean operating times for each procedure and all procedures performed at the five hospitals for each sample quarterly period

	Hospital A B2: Major Non-Metropolitan			Hospital B C1: District Group 1			Hospital C Private Hospital			Hospital D A1: Principal Referral			Hospital E B1: Major Metropolitan		
	1988	1993	1998	1988	1993	1998	1988	1993	1998	1988	1993	1998	1988	1993	1998
Open Cholecystectomy	91.41	102.08	134.29	83.75	81.88	69.13	61.61	108.33	60.00	119.85	126.59	144.88	95.89	122.14	179.00
Laparoscopic Cholecystectomy	n/a	137.67	112.29	n/a	76.26	65.71	n/a	79.77	76.57	n/a	137.50	131.07	n/a	114.44	102.64
All cholecystectomies	91.41	121.85	115.95	83.75	76.68	65.94	61.61	82.29	75.24	119.85	133.21	134.77	95.89	117.21	112.68
Colonoscopy	12.70	13.75	18.16	13.83	23.33	25.68	26.20	23.95	23.15	33.09	33.22	45.60	34.59	21.07	16.07
D&C	10.04	11.43	15.26	14.19	14.10	13.31	10.54	11.33	12.20	17.08	14.55	16.77	7.50	7.50	7.50
D&C Hysteroscopy	n/a	27.92	26.67	n/a	n/a	25.50	n/a	27.50	21.56	n/a	42.34	36.08	n/a	29.45	18.12
All D&C with or without hysteroscopy	10.04	13.60	20.48	14.19	14.10	19.30	10.54	14.74	19.33	17.08	21.52	26.64	7.50	13.68	12.11
Total knee replacement replacement	121.67	130.00	153.89	n/a	n/a	n/a	149.67	148.11	155.56	0	167.50	186.00	0	135.20	102.36
Mean operating minutes for all OTS procedures	**39.97**	**45.82**	**48.47**	**35.44**	**40.94**	**39.15**	**41.41**	**42.88**	**41.22**	**69.13**	**75.24**	**83.61**	**43.52**	**44.27**	**52.50**

Appendix A4: Summarised intra-operative and staffing data for Hospital A for 3 sample periods

	Jul-88 Count	Jul-88 Minutes	Aug-88 Count	Aug-88 Minutes	Sep-88 Count	Sep-88 Minutes	Apr-93 Count	Apr-93 Minutes	May-93 Count	May-93 Minutes	Jun-93 Count	Jun-93 Minutes	Apr-98 Count	Apr-98 Minutes	May-98 Count	May-98 Minutes	Jun-98 Count	Jun-98 Minutes
D&C	47	490	56	600	28	225	27	330	19	180	33	393	24	390	14	210	19	270
D&C with Hysteroscopy	0	0	0	0	0	0	4	105	6	155	2	75	17	550	19	435	12	295
"Open" Cholecystectomy	14	1180	17	1780	8	605	5	450	1	90	6	685	2	315	3	335	2	290
Laparoscopic Cholecystectomy	0	0	0	0	0	0	7	960	5	695	3	410	11	1155	7	970	17	1805
Knee replacement**	1	170	0	0	2	195	1	85	1	145	2	290	4	575	5	825	9	1370
Colonoscopy***	16	175	21	250	13	210	7	115	19	230	18	260	45	885	56	920	51	955
TOTALS FOR PROCEDURES	**78**	**2015**	**94**	**2630**	**51**	**1235**	**51**	**2045**	**51**	**1495**	**64**	**2113**	**103**	**3870**	**104**	**3695**	**110**	**4985**
QUARTERLY PROCEDURE TOTALS					**223**	**5880**					**166**	**5653**					**317**	**12550**
Total operating minutes per month		**16050**		**16885**		**14225**		**15380**		**20430**		**16475**		**24655**		**23180**		**25445**
Total endoscopy cases	53		59		38		37		53		55		118		116		111	
Total cases per month	**396**		**408**		**376**		**343**		**438**		**360**		**520**		**519**		**473**	
QUARTERLY TOTALS					**1180**	**47160**					**1141**	**52285**					**1512**	**73280**
% Procedures of Total Theatre caseload					**18.90%**	**12.47%**					**14.55%**	**10.81%**					**20.97%**	**17.13%**
TOTAL Op minutes D&C						1315						903						870
TOTAL Op minutes D&C Hysteroscopy						0						335						1280
TOTAL cases per quarter						131						91						105
TOTAL minutes (D&C and Hysteroscopy)						**1315**						**1238**						**2150**
Average D&C + Hysteroscopy minutes						**10.0**						**13.6**						**20.5**
TOTAL Op minutes Abdo Chole						3565						1225						940
TOTAL Op minutes Lap Chole						0						2065						3930
TOTAL cases per quarter						39						27						42
TOTAL minutes (Abdo/Lap Chole)						**3565**						**3290**						**4870**
Average Abdo/Lap Chole minutes						**91.4**						**121.9**						**116.0**
TOTAL Colonoscopies per quarter						50						44						152
TOTAL Colonoscopy minutes per quarter						635						605						2760
Colonoscopy as proportion of endoscopy	**30.19%**		**35.59%**		**34.21%**		**18.92%**		**35.85%**		**32.73%**		**38.14%**		**48.28%**		**45.95%**	
Average Colonoscopy minutes						**12.7**						**13.8**						**18.2**
Total Op minutes Knee Replacement						365						520						2770
Average Knee Replacement minutes						**121.67**						**130.00**						**153.89**
Total Knee replacements (count)						**3**						**4**						**18**
Working staff establishment FTE						**23.58**						**26**						**26.6**
Operating minutes per FTE per month						666.67						670.32						918.30
Cases per FTE per month					16.68						14.63						18.95	
					CSD	**Op Theatre**					**CSD**	**Op Theatre**					**CSD**	**Op Theatre**
Full staff establishment (FTE) exclusive of non-nursing/technical staff					7.58	16					7	19.00					7	19.6

Appendix A5: Time study summary of perioperative human labour input to selected procedures at Hospital A

*Treat decontamination of case carts and/or trolleys as *ceteris parabis*

*Treat maintenance of surgeon preference cards as *ceteris parabis*

* Treat management of specimens for pathology as *ceteris parabis*

*Treat delivery to OS and shelving as *ceteris parabis*

* Changes in training requirements have not been quantified

NOTE #1: The time in minutes for each stage represents the total human labour input for that stage (eg. 30 minutes labour could be 10 mins labour of one person overlapping 20 minutes labour of another).

NOTE #2: Standard activities involved in each stage need to be described from researcher's field observation notes.

Dilatation of cervix & Curettage of uterus (D&C): Total labour input

(Times in minutes)	Pre-op equipment assembly in OS	Pre-op non-sterile setup in OR	Pre-op sterile setup in OR	Post-op clear up in OR (all)	Sort & wash in SD	Check & pack in SD	Pre- and post-sterilise in SD	Quickest perioperative scenario	Longest perioperative scenario	Average perioperative scenario	Apr-Jun98 Count	Total periop minutes
Shortest stage time	0.4	2.0	6.0	10.0	18.0	3.0	0.5	**39.92**				
Longest stage time	0.7	2.0	9.3	11.3	18.0	3.0	0.5		**44.77**			
Average stage time	0.54	2.00	7.63	10.67	18.00	3.00	0.5			**42.34**	57	2413.475
Number observed	2	2	2	2	1	1	2					

D&C with hysteroscopy: Total labour input

(Times in minutes)	Pre-op equipment assembly in OS	Pre-op non-sterile setup in OR	Pre-op sterile setup in OR	Post-op clear up in OR (all)	Sort & wash in SD	Check & pack in SD	Pre- and post-sterilise in SD	Maintain hysteroscope /accessories	% Steris maintenance QA activities	Quickest perioperative scenario	Longest perioperative scenario	Average periop scenario	Apr-Jun98 Count	Total periop minutes
Shortest stage time	4.1	3.7	10.8	14.6	24.0	4.0	0.8	2.65	3	**67.65**				
Longest stage time	5.1	9.3	14.8	20.3	24.0	4.0	0.8	2.65	3		**84.01**			
Average stage time	4.62	5.46	12.1	16.92	24	4	0.75	2.65	3			**73.50**	48	3528.16
Number observed	2	5	4	5	1	1	3							

Laparotomic (Open) Cholecystectomy: Total labour input

(Times in minutes)	Pre-op equipment assembly in OS	Pre-op non-sterile setup in OR	Pre-op sterile setup in OR	Post-op clear up in OR (all)	Sort & wash in SD	Check & pack in SD	Pre- and post-sterilise in SD	Quickest perioperative scenario	Longest perioperative scenario	Average perioperative scenario	Apr-Jun98 Count	Total periop minutes
Shortest stage time	16	4	16	12	7	17	2	**74**				
Longest stage time	16	4	16	12	7	17	2		**74**			
Average stage time	16	4	16	12	7	17	2			**74**	7	518
Number observed	1	1	1	1	1	1	1					

Laparoscopic Cholecystectomy: Total labour input *Exclusive of Steris processing time of 30 minutes

(Times in minutes)	Pre-op equipment assembly in OS	Pre-op non-sterile setup in OR	Patient positioning*	Pre-op sterile setup in OR*	Post-op clear up in OR (all)	Sort & wash + check & pack in SD	Pre- and post-sterilise in SD*	Maintain laparoscope /accessories	Maintain "disposables" stock levels	% Steris maintenance & QA activities	Quickest perioperative scenario	Longest periop scenario	Average perioperative scenario	Apr-Jun98 Count	Total periop minutes
Shortest stage time	5	5.22	3.9	38.5	16	35	3	6	2	3	**117.62**				
Longest stage time	5	20	8.5	52.9	26.7	40	3	6	2	3		**167.10**			
Average stage time	5	10.18	5.98	45.58	21.12	37.5	3	6	2	3			**139.36**	35	4877.5
Number observed	3	7	5	5	5	2	1	5							

*Positioning is included because there are no special positioning requirements of laparotomic (open) cholecystectomy

*This hospital has instituted a comprehensive QA system in the SD which involves tracking all sterilised items

Flexible colonoscopy: Total labour input per procedure (see NOTE)

(Times in minutes)	Pre-list preparation of procedure room*	Pre-list preparation of procedure room per case @ 4 per list	Pre-procedure preparation of equipment trolley	Post-procedure clear up of procedure room	Post-procedure cleaning & decontamination of colonoscope & accessories*	Post-procedure removal of scope from Steris & reassembly of colonoscope	Post-list clear up & restock of Proc. room per case based on 4 per list	Post-list care and storage of scopes /accessories	Steris maintenance and quality assurance activities	Biopsy forceps processing in SD	Quickest perioperative scenario	Longest periop scenario	Average perioperative scenario	Apr-Jun98 Count	Total periop minutes
Shortest stage time	32.0	8.0	2.0	6.0	12.8	1.0	7.5	5.0	3	2	**47.25**				
Longest stage time	45.0	11.3	6.0	8.6	15.8	2.0	8.5	10.0	3	2		**67.13**			
Average stage time	38.5	9.63	3.67	7.28	14.02	1.5	8	7.5	3	2			**56.59**	152	8601.51
Number observed	2		6	2	3	6	2								

NOTE: One patient might have two procedures (ie. gastroscopy + colonoscopy)

*Steris machine processing time for one colonoscope is average of 23 minutes (not included)

When one list of 10 patients (using 13 endoscopes) finished, 6 endoscopes remained to be processed, representing 6x23 = 138 minutes of Steris machine time alone

*NOTE: This hospital has not commenced the practice of decontaminating colonoscopes immediately prior to the commencement of the procedure.

Total knee replacement arthroplasty (TKR) non-loan set: Total labour input

Duracon: Oct 98

	Pre-op equipment assembly in OS	Pre-op non-sterile setup in OR	Pre-op sterile setup in OR	Post-op clear up in OR (all)	Sort & wash in SD	Check & pack in SD	Pre- and post-sterilise in SD	Manage stock of prostheses	Quickest perioperative scenario	Longest perioperative scenario	Average perioperative scenario	Apr-Jun98 Count
Stage time (mins)	40	26	40	25	100	70	30	10			**341**	5

Total knee replacement arthroplasty (TKR) loan set: Total labour input

Nexgen - 10 boxes: 8-10 Dec 98

	Order consignment equipment from company	Check in all instruments delivered in consignment	Check in consignment prostheses	Pre-op sort & wash in SD	Pre-op check & pack in SD	Pre-op pre- and post-sterilise in SD	Pre-op equipment assembly in OS	Pre-op non-sterile setup in OR	Pre-op sterile setup in OR	Post-op clear up in OR (all)	Post-op sort & wash in SD	Post-op check /pack in SD	Post-op pre- & post-sterilise in SD	Post-op prostheses check / pack for return to company	Prepare loan equipment for return to company
Stage time (mins)	5	60	20	90	15	10	20	30	55	25	90	120	15	15	10

Quickest periop scenario	Longest periop scenario	Average periop scenario	Grand mean **Periop scenario for TKRA**	Apr-Jun98 Count	Total periop minutes
		580	**513.61**	18	9245

Added time due to loan set	210
Mean perioperative time	580
Difference	370
% difference	36.21%
Non-loan periop time	341

% Increase represented by "added time due to loan set" 56.76%

Appendix A6: Sample perioperative time study data from each hospital

Appendix A6 Table 1: Open Cholecystectomy (at Hospital C)

	Pre-op equipment assembly in OS	Pre-op non-sterile setup in OR	Pre-op sterile setup in OR	Post-op clear up in OR (all)	Sort & wash in SD	Check & pack in SD	Pre- and post-sterilise in SD	Mean perioperative scenario
Average stage time (mins)	14	5	17.73	7.4	14.25	23.82	1.25	**83.45**

Appendix A6 Table 2: Colonoscopy (at Hospital D)

	(a) Pre-list preparation of scopes in processing room	(b) Pre-list preparation of procedure room	Pre-list preparation based on 4 cases per session (a+b)÷4	Pre-procedure preparation of equipment trolley	Post-procedure clear up & preparation of procedure room	Post-procedure cleaning & sterilising of colonoscope & accessories	Post-procedure removal of scope from Medivator & reassembly of colonoscope	Post-list clear up & restock of procedure room per case based on 4 per list	% Routine* pathology tests on colonoscopes & accessories	% Medivator maintenance and quality assurance activities	Instrument reprocessing in SD	Mean perioperative scenario
Average stage time (mins)	115.5	33.5	37.3	2.0	13.2	19.4	2.1	10.0	4.0	11.1	2.6	**101.52**

NOTE: Medivator maintenance activities are an average based on the total number procedures during April-June 1998.

Appendix A6 Table 3: Dilatation of Cervix & Curettage of Uterus (D&C) (at Hospital B)

	Pre-op equipment assembly in OS	Pre-op non-sterile setup in OR	Pre-op sterile setup in OR	Post-op clear up in OR (all)	Sort & wash, in SD	Check & pack in SD	Pre- and post-sterilise in SD	Mean perioperative scenario
Average stage time (mins)	2.0	4.0	7.5	7.93	3.7	2.33	0.63	**28.09**

Appendix A6 Table 4 provides an example of how the shortest times and longest times taken to complete each perioperative stage were tabulated. However these data were collated from the raw data for each procedure at each site, so they do not represent the perioperative data for an entire case observed from beginning to end. Hence, it would be erroneous to assume that they reflect the actual range in total processing times occurring at a particular hospital. The example is given simply to demonstrate what must be regarded as the normal within-hospital variation that occurs in the various stages of production of similar procedures. It is also given to support my contention that using the calculated mean time for each perioperative stage to derive a mean total perioperative time for each procedure at each hospital is the best approach to use to serve the purposes of the present thesis. **Appendix A6 Table 5** provides the shortest, longest and mean times for total knee replacement at Hospital E, but contrary to the data for the other five procedures, the shortest and longest scenarios pertain to single cases that have employed a specific brand of prostheses and intra-operative artefacts.

Appendix A6 Table 4: Example of time study stages and record-keeping – D&C with Hysteroscopy (from Hospital A)

	Pre-op equipment assembly in OS	Pre-op non-sterile setup in OR	Pre-op sterile setup in OR	Post-op clear up in OR (all)	Sort & wash in SD	Check & pack in SD	Pre- and post-sterilise in SD	% Maintain hysteroscope & accessories	% Steris maintenance & QA activities	Quickest perioperative scenario	Longest perioperative scenario	Mean perioperative scenario
Shortest stage time (mins)	4.1	3.7	10.8	14.6	23.0	4.0	0.8	2.65	3	**67.65**		
Longest stage time (mins)	5.1	9.3	14.8	20.3	25.0	4.0	0.8	2.65	3		**84.01**	
Average stage time (mins)	4.62	5.46	12.1	16.92	24	4	0.75	2.65	3			**73.50**
Number observed	2	5	4	5	2	2	3					

In the following example, pre-operative instrument processing (ie. the sum of the mean perioperative times in cells (a) to (f)) combined with (p) "post-operative loan set dispatch", accounted for 229.5 minutes in the mean perioperative time of 622.3 minutes – time that is not required when hospital-owned instruments are used.

Appendix A6 Table 5: Total knee replacement – with loan sets (at Hospital E)

	(a) Order loan equipment from company	(b) Check in all loan instruments on arrival	(c) Unpack & check in sterile consignment prostheses	(d) Pre-op sort & wash loan instruments in SD	(e) Pre-op check & pack loan instruments in SD	(f) Pre-op pre- and post-sterilise sterilise in SD	(g) Pre-op equipment and instrument assembly in OS	(h) Pre-op non-sterile setup in OR	(i) Pre-op sterile setup in OR	
Shortest stage time (mins)	5	32	15	40	50	4	16	10.3	53.5	
Longest stage time (mins)	5	72	15	90	126	5	16	13.9	56.7	
Average stage time (mins)	5.0	55.8	15.0	55.0	87.8	4.5	16.0	12.2	55.1	
Number observed	3	5	2	4	4	3	2	2	2	
	(j) Post-op clear up in OR (all)	(k) Disassemble & rinse all instruments in OS	(l) Post-op wash all instruments in SD	(m) Post-op sort, check & pack all instruments in SD	(n) Post-op pre- and post-sterilise all instruments in SD	(o) Post-op consignment prostheses check & pack for return to company	(p) Prepare loan equipment for return to company	Quickest perioperative scenario	Longest perioperative scenario	**Mean perioperative scenario**
Shortest stage time (mins)	31.0	40	40	80	15	18	5.8	**455.6**		
Longest stage time (mins)	34.8	100	120	130	45	18	7.0		**854.4**	
Average stage time (mins)	32.9	63.0	69.4	99.2	27.0	18.0	6.4			**622.3**
Number observed	2	5	5	5	5	1	4			

NOTE: Four different "brands" of total knee prostheses are represented in this sample

Appendix A7

Method employed in deriving operating room service weights measures for selected procedures

Table 2(h) revealed how the six procedures I have examined in the present thesis have been assigned eleven AR-DRG version 4.0 codes to reflect the variability that can occur in the treatment (and hence, the costs) of similar illness conditions. However, for the purposes of this analysis, all similar procedures have been grouped (resulting in six categories – one for each of the procedures of interest) and their various data aggregated to produce *grand mean* values for each of the following variables for the six procedures:

- Estimated sterilising department human labour cost component of the NORSW
- Estimated Operating Suite human labour cost component of the NORSW
- OR service weight.

All *grand mean* values have been calculated using the same conventional mathematical logic. For example, where the volume of separations by DRG is given as $\boldsymbol{f}$, the NORSW for a specific DRG is given as $\boldsymbol{w}$, and the total separations for those DRGs which are categorically the same is given as $\boldsymbol{v}$, grand mean NORSW for all similar procedures can be calculated using the equation:

$$\textit{Grand mean NORSW} \text{ for all similar procedures } = (\Sigma\, fw)/v$$

To demonstrate, in the case of total knee replacement (using the 1997/98 Australian public hospital data in **Table 2(h)** and the NORSW data in **Table 2(i)** as an example), there are two DRG codes. So where $f_1 = 1257$ and $f_2 = 6530$, and $w_1 = 6.38$ and $w_2 = 5.98$, the grand mean NORSW for all total knee replacements is calculated as:

$$(\Sigma\, fw)/v = [(w_1)(f_1)+(w_2)(f_1)] \div (f_1+f_2) = [(6.38)(1257)+(5.98)(6530)] \div (1257 + 6350) = \underline{6.045}$$

However, due to difficulties correlating the AR-DRG version 4.0 codes with the DRG codes used in the 1995 NORSW data set, the frequencies of procedures used in the human resource cost calculations are total separations for each procedure in NSW in 1996/97 shown in the following table.

MDC	Description	No. in NSW in 1996/97	HR costs in SD	HR costs in OS
333	Complex Therapeutic Colonoscopy	323	$46.00	$147.00
334	Other Colonoscopy W CC	3654	$54.00	$120.00
335	Other Colonoscopy W/O CC	46844	$50.00	$106.00
365	Cholecystectomy W C.D.E. W CC	177	$119.00	$542.00
366	Cholecystectomy W C.D.E. W/O CC	480	$81.00	$561.00
367	Cholecystectomy W/O C.D.E.	12846	$99.00	$441.00
406	Knee Replacement W CC	1947	$145.00	$504.00
407	Knee Replacement W/O CC	3468	$119.00	$465.00
661	Dx Curettage &/or Dx Hysteroscopy	11479	$99.00	$98.00

Sources: NSW Health (1998b; 1998c).

So, where mean SD and OS human resource costs for a DRG is given as $\boldsymbol{c_{SD}}$ and $\boldsymbol{c_{OS}}$ respectively, the grand mean OTS human resource costs for each of the six procedures in 1996/97 are calculated by summing the individual sterilising department (SD) and operating suite (OS) human resource costs using the estimates reported in **Table 2(i)** in the following equation:

$$\textit{Grand mean SD (or OS) human labour cost} \text{ for all similar procedures} = (\Sigma\, fc)/v$$

For example, in the case of the two DRG codes for total knee replacement (TKR) (above), the SD human resource cost in the NORSW for code 406 is $145 and for code 407, $119. So the *grand mean SD human resource cost* for a total knee replacement would be:

$$(\Sigma\, fc_{SD})/v = [(c_1)(f_1)+(c_2)(f_1)] \div (f_1+f_2) = [(\$145)(1947)+(\$119)(3468)] \div (1947 + 3468) = \underline{\$128.35}$$

This result is then adjusted to reflect the reduced mean total cost per procedure in the OTS from $1,190 in 1995 to $973 in 1998, resulting in an estimated 1998 SD human resource cost of $104.94 for a TKR. Using the same method, the 1998 OS human resource cost for TKR is $391.67. These data, and data calculated for the other five procedures, are reported in **Table 5(k)**.

Appendix B1

Interview Questions Y: Senior Health Service Managers

1. Thankyou for making the time to talk with me.

   Before starting the interview, I need to attend to a few administrative matters. The first is to review the contents of the *Research Participant and Consent Form*, [read document, or confirm that participant has read it] and obtain your signature on each copy - one for you and one for my records. I want to remind you that by signing the consent form, you are agreeing to this interview being taped. If you want to stop the tape at any time and wipe something you've said, that's alright.....

2. Do you have any questions about the consent form or this interview? .....Is it OK to start the interview now?

3. Would you give me a brief overview of your background/experience working in health services management?

4. Have you undertaken formal study in (the principles of) management - at TAFE or university? If yes ..... "Please elaborate."

5. Is it correct that you have some work responsibilities which relate to the financial management or control of the surgical services delivered in the operating theatre at hospital [name]?

6. Does your job include any responsibilities which can affect staffing levels in the operating theatre suite?

7. Does your job description specify what all these responsibilities are?

8. If yes ..... "Please briefly describe these responsibilities."

9. Approximately how long have you had these types of responsibilities at this or any other health care organisation?

10. Do you individually or as part of a team, have the capacity to influence decisions about surgical equipment purchases for the operating theatre suite? I'm thinking specifically in terms of what is purchased and the levels of expenditure.

11. Can you think of any significant operating theatre equipment purchase - preferably equipment which could be described as being a new type of technology for your facility - for which the decision to purchase was simple or uncomplicated? [By 'significant' I mean an expenditure in excess of about $25,000.] [If an explanation is needed, add "for example, an operating microscope or fibreoptic systems for minimally invasive surgery".]

12. Can you recall what prompted someone in your organisation to suggest that this equipment should be acquired? What benefits were expected?

13. Would you tell me about the main factors which influenced your decision to support (or approve) this purchase/acquisition?

14. Can you think of another similar category of purchase - or proposal to purchase, but one which cost at least $10,000 - and tell me why you did or did not support (or approve) it? [If an explanation is needed, add "for example, a specialist operating table or a Sterimed system for specialist equipment sterilisation).]

15. Can you recall what prompted someone in your organisation to suggest that this equipment should be acquired? What benefits were expected?

16. Would you tell me about some of the main factors which influenced your decision (not) to support (or approve) this purchase?

17. Can you think of any significant surgical equipment purchase - again, equipment which could be described as representing 'a new or innovative technology' - for which the decision (not) to purchase was difficult, and perhaps fraught with disagreement?

18. Can you recall what prompted someone in your organisation to suggest that this equipment should be acquired? What benefits were expected?

19. On what basis did you, or did you not support (or approve) the purchase?

20. Going back to the surgical technologies that you mentioned earlier, could you tell me if you had any expectations of the impact of one or more of these technologies on **patient safety and quality of care**? If yes..... "Please elaborate." .....Have these expectations been realised?

21. Could you tell me if you had any expectations of the impact of one or more of these technologies on **health outcomes**? If yes..... "Please elaborate." .....Have these expectations been realised?

22. Could you also tell me what you expected to be the **budgetary implications** of the decision to acquire one or more of these technologies? .....Have these expectations been confirmed?

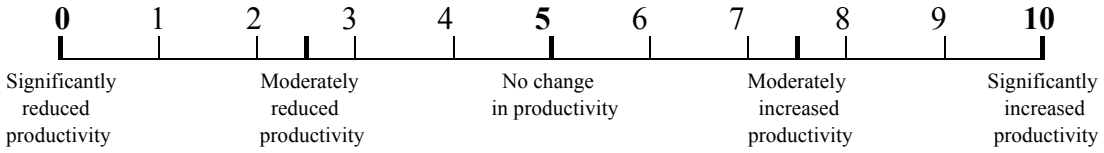
23. And lastly on this theme, did you have any expectations of the impact of one or more (of these technologies) on the **worklife** of the operating theatre staff? If yes..... "Please elaborate." .....Have these expectations been realised?

24. Did any of these four issues carry greater weight than others in influencing the decisions to acquire (or not to acquire) the technologies? [Be specific about which surgical technology is being referred to.]

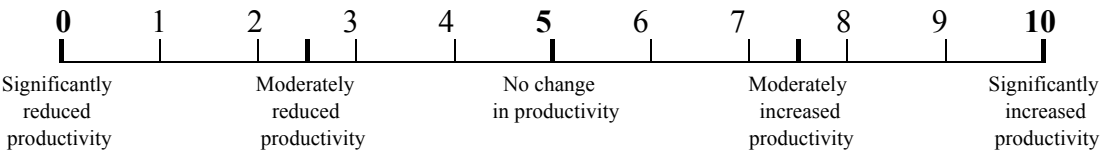
25. Within the four domains just mentioned relating to the technologies (in questions 20, 21, 22 & 23), are you aware of any positive or negative outcomes which only came to light after the technology had been introduced?

Comment: "I now want to change the focus of the questions away from specific technologies to all the technologies which have been introduced into operating theatres over the last ten years. The next eight questions require you to make your responses on this document [hand to informant]. The questions are similarly structured and there are two questions on each of four topics: employee productivity, operating theatre throughput, operating theatre cost-efficiency, and the quality of worklife of operating theatre staff. After considering each question, could you place a **X** at the point along the scale which best represents your response."

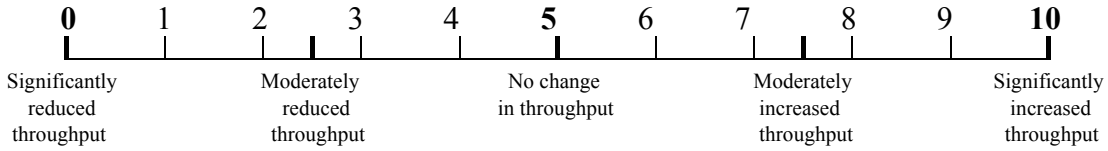
26. Could you indicate on this Likert scale what you **(might have) expected to be** the overall effect of the expanding use of high technology surgical instruments/equipment on **employee productivity** in the operating theatre over the last ten years.



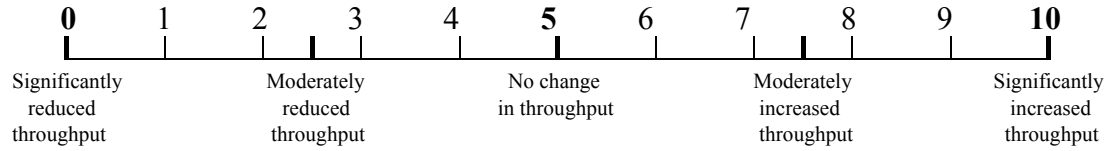
27. Could you indicate on this Likert scale what you think **has been** the overall effect of the expanding use of high technology surgical instruments/equipment on **employee productivity** in the operating theatre over the last ten years.



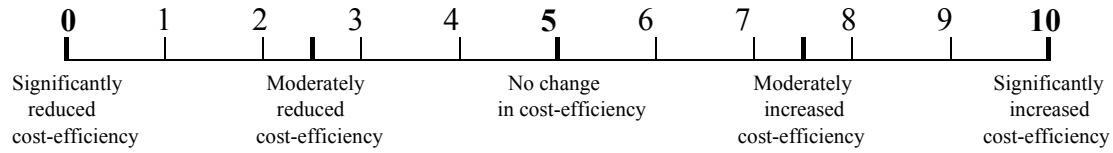
28. Could you indicate on this Likert scale what you **(might have) expected to be** the overall effect of the expanding use of high technology surgical instruments/equipment on **operating theatre throughput** over the last ten years.



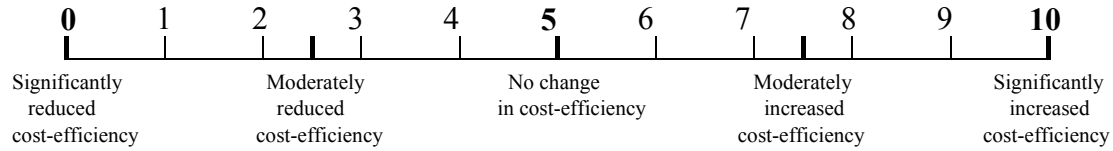
29. Could you indicate on this Likert scale what you think **has been** the overall effect of the expanding use of high technology surgical instruments/equipment on **operating theatre throughput** over the last ten years.



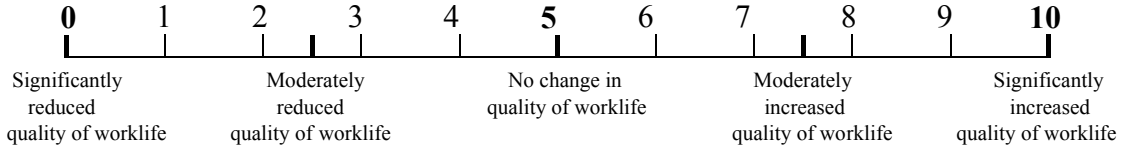
30. Could you indicate on this Likert scale what you **(might have) expected to be** the overall effect of the expanding use of high technology surgical instruments/equipment on **cost-efficiency** in the operating theatre over the last ten years.



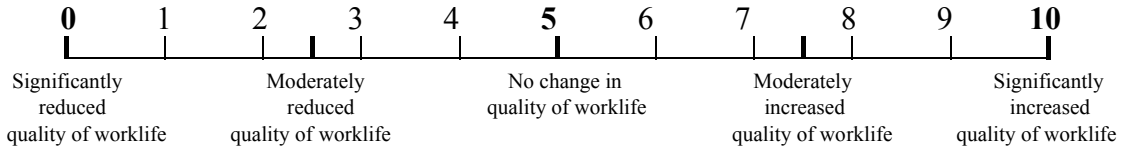
31. Could you indicate on this Likert scale what you think **has been** the overall effect of the expanding use of high technology surgical instruments/equipment on **cost-efficiency** in the operating theatre over the last ten years.



32. Could you indicate on this Likert scale what you **(might have) expected to be** the overall effect of the expanding use of high technology surgical instruments/equipment on the **quality of worklife of staff** in the operating theatre over the last ten years.



33. Could you indicate on this Likert scale what you think **has been** the overall effect of the expanding use of high technology surgical instruments/equipment on the **quality of worklife of staff** in the operating theatre over the last ten years.



34. The last two questions were about the quality of worklife of operating theatre staff. Would you like to add any comments to those you gave me earlier [in question 23] about your expectations of the impact of one or more of the technologies you described earlier, on the **worklife** of the operating theatre?

35. Could you make some general comments on what you think are the main factors that have driven hospitals to acquire new surgical technologies over the last decade?

Comment: "In the few remaining questions I want you to focus again on the technologies which you talked about early in the interview. [If necessary, remind informant of what those technologies were.]

36. Are you aware of any audit or formal assessment procedures which are in place in your hospital (or area health service) to evaluate the outcomes of significant surgical equipment purchases against the proposals for their acquisition? If yes..... "Could you give me an example?"

37. [If Q.5 = "yes"] You mentioned earlier that you had studied management. Do you think that any of the principles learned during your management studies have influenced you in any of the technology decision situations you described to me earlier? If yes..... "Can you briefly explain how?"

38. Have any management principles espoused by any of your mentors, peers or senior managers been adopted by you, and played a part in the technology decision situations you've described? If yes..... "Can you briefly explain how?"

39. Would you like to add any comments?

Thank you for your contribution to my research, and your time. Before we finish, I need to make one important request, and that is that you refrain from discussing this interview with other people. It's remotely possible that you could talk to another participant, and this could influence his/her ideas and comments - and compromise my research.

40. [Witness coding of audio-tape cassette and sign participant sheet]

Appendix B2

Telephone Interview Questions - Procedural Specialists
Form Z

A study of the changes in the nature and volume of work associated with technological developments in surgery performed in operating theatre suites since 1988 in Australia.

The proposed interview will follow the line of questioning detailed below:

1. What is your area of surgical or medical specialisation?
2. For how many years have you practised in this specialist area?
3. What factors influenced your choice to specialise in this area?
4. Is it correct that you perform surgery/procedures within the operating theatre suite at Hospital x?
5. Thinking of the range of surgery/procedures that you perform, could you comment on the types of techniques and technologies that were characteristic of the way that you performed your most common types of "routine" surgery/procedures today compared to ten years ago? What are the similarities and dissimilarities?
6. Do you recall (and if so, provide brief details of) any specific periods in your practice when changes occurred in either the way you performed some types of surgery and/or you were able to undertake new procedures that had been made possible by advancements in technologies?
7. What impact have new techniques and technologies had on you at a professional and/or personal level?
8. What are some of the main factors that have influenced you to adopt new techniques?
9. Have you been aware of any issues that have changed turnaround times between cases on your surgical lists over the last ten years? If so, could you explain what has happened to turnaround times, and what you think are the issues implicated in any change?
10. Could you briefly explain how your role in the surgical team differs from the role(s) of nursing personnel, specifically in relation to the surgical instruments and other technologies before, during and after an operation/procedure?
11. What are your expectations of Operating Theatre Suite staff when a new technology is planned for use in conjunction with surgery/procedures that you perform?

Appendix C1

Frequency of interview themes - Sterilising Department Technical Aides

THEME	AX002	BX002	CX001	DX007	DX008	EX001	EX002	TOTAL
DECISION ROLE	0	0	0	0	2	0	0	**2**
DECISION_POLITICS	0	0	0	0	4	1	0	**5**
NAT TASK_DESCRIBE OTHER	3	13	5	8	5	6	2	**42**
NAT TASK_DESCRIBE TECHNOL	3	12	6	5	8	5	3	**42**
NAT TASK_CUSTOMISED	0	0	0	1	4	0	1	**6**
NAT TASK_STANDARDISED	2	1	0	1	2	5	0	**11**
NAT TASK_ROUTINE	0	1	1	2	0	5	0	**9**
NAT TASK_VARIABLE	3	4	1	3	11	13	6	**41**
NAT TECH_COMPLX_HI	3	3	3	9	11	5	7	**41**
NAT TECH_COMPLX_LO	3	2	1	3	0	0	0	**9**
NAT TECH_INNOV_HI	1	0	0	2	7	3	2	**15**
NAT TECH_INNOV_LO	1	1	2	0	0	1	1	**6**
NAT TECH_QUANT_HI	1	0	2	3	5	5	2	**18**
NAT TECH_QUANT_LO	0	1	1	0	0	0	0	**2**
TECHNICAL GOAL	2	2	0	0	2	0	1	7
VOL WORK_DEC_MANUAL	0	0	1	0	0	0	0	**1**
VOL WORK_DEC_OTHER	0	1	0	0	0	0	0	**1**
VOL WORK_DEC_TECHNOL	4	4	0	0	1	1	0	**10**
VOL WORK_INC_MANUAL	3	2	4	5	4	2	3	**23**
VOL WORK_INC_OTHER	6	1	3	3	1	2	1	**17**
VOL WORK_INC_TECHNOL	1	4	2	0	5	4	2	**18**
VOL WORK_STAT_MANUAL	0	0	1	1	0	0	0	**2**
VOL WORK_STAT_OTHER	0	0	0	0	0	0	0	**0**
VOL WORK_STAT_TECHNOL	2	2	1	0	0	0	0	**5**

Appendix C2: Results of Likert-scaled questions in interviews with Health Service Managers

0 = Very significant reduction
5 = No change
10 = Very significant increase

Clinical background ?	Gender	Participant code	Q26 Expected Changes in Employee Productivity	Q27 Actual Changes in Employee Productivity	Q28 Expected Changes in Theatre Throughput	Q29 Actual Changes in Theatre Throughput	Q30 Expected Changes in Cost-Efficiency	Q31 Actual Changes in Cost-Efficiency	Q32 Expected Changes in Quality of worklife	Q33 Actual Changes in Quality of worklife
Yes	F	BY001	9	4	9	6	7	4	6	7
Yes	F	CY001	7.5	5	10	7.5	2.5	2.5	7.5	10
Yes	F	CY002	7.5	4	9	2	7	2	9	5
Yes	F	EY001	2.5	2.5	3	4	0.5	1	1	4
No	M	AY001	8.5	8.5	7.2	8.8	7.8	4.4	8.3	8.3
No	M	AY002	7.5	7.5	10	10	6	6	7.5	7.5
No	M	AY003	8	8	8	9	6	7	7	7
No	M	BY002	6	7	6	5	4	3	7	8
No	M	BY003	7	7	10	0	4	7	7.5	7.5
No	M	DY001	7	6	7	6	7	6	7.5	7.5
No	M	DY002	8	6	7	7	3	3	7.5	6
No	M	EY002	7.3	7.3	7.8	7.8	5.5	5.5	5	5
No	M	EY003	7.2	7	8	8.2	6.7	6.7	8	8
		Mean =	7.15	6.14	7.85	6.25	5.15	4.47	6.83	6.98
		SD =	1.58	1.78	1.94	2.89	2.18	2.04	2.01	1.62

t-test

t test using using Ex as pop mean & SD			-2.3126		-2.9525		-1.1309		0.2757	
			df = 12		**df = 12**		**df = 12**		**df = 12**	
		Alpha = 0.05, Crit t =	2.179		2.179		2.179		2.179	

Appendix D1

Themes, definitions and codes

Level 1, Theme 1: Nature of technology (NAT TECH_)

Nature of the technologies employed in the production of the product or service.

Level 2 themes

AUTO = Reference is made to the current degree of automation of the production process resulting from the application of technologies (eg. a high degree of automation = AUTO_HI).

COMPLX = Reference is made to the complexity of technological hardware used by workers in the course of their work

INNOV = Reference is made to a propensity of the work process to technological innovation and possibly to the adoption of that technology resulting in change(s) to the work process and/or its product.

QUANT = Reference is made to the overall quantity of the technological hardware and/or the 'knowledge' component of technologies used by a worker in the work process on either a trial or "adopted" basis.

UNCERT = Technological uncertainty (Thompson's 'standardised ← → customised'). Reference is made to the manner in which a specific technology is applied during multiple applications – ranging from 'the same all the time' = standardised = UNCERT_LO; to 'potentially different in every application' = customised = UNCERT_HI.

VARIAB = Routineness ← → Variability of technology (after Perrow). Reference is made to the overall diversity of technologies and/or the within-type diversity of the technologies used by a worker – ranging from 'few technologies with no within-type variations' = routine = VARIAB_LO; to 'many technologies and many with within-type variation' = variable = VARIAB_HI.

[Level 3: Qualifiers of groups themes: LO = low; MOD = moderate; HI = high]

Level 1, Theme 2: Goals of the technologies (TECH GOAL)

Goals of the technologies - A goal or purpose of employing the technology in the production process. The informant comments on any of the Level 2 themes (below) as being a goal of introducing new intra-operative artefacts into operating theatre services.

Level 2 themes

COST EFF HOSP = Cost efficiency (ie. value for dollars spent) for the hospital.

COST EFF OTS = Cost efficiency (ie. value for dollars spent) for operating theatre services (includes sterilising department and endoscopy unit services).

FRAG = Task fragmentation (ie. the traditional sense of 'division of labour'); Reference is made to the work contributing to a single product/service being broken into smaller units as a result of the technological innovation.

MANAGE = Effectiveness of the management of the service, department/unit and/or hospital.

PROD HOSP = Productivity of the hospital.

PROD OTS = Productivity of operating theatre services (includes sterilising department and endoscopy unit services).

QUALITY = Quality of the process that impacts either directly or indirectly on the patient, and/or the health outcome of the patient in the short, medium and/or long term.

QWL = Quality of work life of users of technology (includes occupational health & safety issues) (nurses, technicians and/or procedural specialists)

[No level 3 themes.]

Level 1, Theme 3: Nature of work (NATURE OF WORK_)

Nature of work (characteristics of the work, design of the labour process and/or characteristics of the workplace). The informant describes current and/or changing characteristics of his/her work or workplace:

Level 2 themes

TECHNOL = Reference is made to the nature of an individual's work changing somehow as a consequence of the adoption of a new intra-operative artefact.

OTHER = Reference is made to the nature of an individual's work changing as a consequence of factors other than TECHNOL.

[No level 3 themes.]

Level 1, Theme 4: Volume of work (VOL WORK_)

Volume of work generally, or specifically associated with the technologies employed in the production of the product or service.

Level 2 themes

DEC = decrease; STAT = static; INC = increase

Level 3 themes

TECHNOL = Reference is made to changes in the overall volume of work for individual workers resulting from the adoption of new intra-operative artefacts.

MANUAL = Reference is made to changes in degree (or volume) of manual labour input to the production process resulting specifically from the application of new technologies.

OTHER = Reference is made to changes in the overall volume of work for individual workers, but the cause of the change cannot be categorised as TECHNOL or MANUAL, or is otherwise not specified.

Level 1, Theme 5: Decision role (DECISION ROLE_)

Reference is made by the informant to participating either formally or informally in some way in the process that might result in the adoption of a new intra-operative artefact within the operating theatre service in which he/she works. The chunks of text thus coded were subsequently analysed to identify specific types of decision roles.

[No level 2 or 3 themes.]

Other themes explored

CARE OF PATIENT = Reference is made to the nurses' care of the patient whilst in the operating theatre suite or endoscopy unit.

CLOSED OCCUP COM = The informant says something that indicates a view that the operating suite is a work environment that is "closed" in physical, cultural and/or professional senses, and therefore people who do not work in it do not understand, or have a very limited understanding of the nature of operating theatre work and/or its impact on those who work there.

CUSTOMISED = The informant says something about the surgical production process being customised to individual patients.

DESKILL YES = An ORN or STER (*Informants X*) presents the view that the diversity and/or level of skills required to do his/her work are now *less* than they were during the previous 10 years. If *Informants Y*, the view is presented that the diversity and/or level of skills required of a worker in a specific department/unit of operating theatre services are now *less* than they were during the previous 10 years.

DESKILL NO = An ORN or STER (*Informants X*) presents the view that the diversity and/or level of skills required to do his/her work are now *at least no less* than they were during the previous 10 years. If *Informants Y*, the view is presented that the diversity and/or level of skills of a worker in a specific department/unit of operating theatre services are now *at least no less* than they were during the previous 10 years.

DIFF BETWEEN SPEC = The informant has made some distinction between aspects of the work associated with different surgical specialties.

GENDER = The informant uses gender distinctions in the course of presenting a view on some aspect of the workplace and/or the technical or other characteristics of the work itself in operating theatre services.

INTRO TO THEATRE = The informant comments on his/her early experiences of working in operating theatre services, and possibly mentions factors that attracted him/her to work in them.

MULTISKILLED = Reference is made to the diversity of skills required of individual workers; the term 'multi skilled' might be used.

ORG POLITICS = The informant says something about the behaviour of stakeholders that is evidence of "politicking", or political behaviour, specifically in relation to the adoption of new intra-operative artefacts.

ROLE DELINEATION = Informant says something about the delineation of roles between different categories of workers within operating theatre services.

SPECIALISE = Reference to the specialist nature of the work in a specific department/unit of operating theatre services.

STRESS = The informant has used the word "stress" (or its synonyms) in some form in relation to his/her work.

TEAMWORK = The informant has used the word "teamwork" (or similar) in relation to work within operating theatre services.

TRAINING = The informant has made a comment about education and/or training issues associated with the unique characteristics of surgical technologies and/or changes in surgical technologies - includes orientation, professional development and in-service education.

Appendix D2

Explanation of text coding themes and sub-themes

Section 4.7.7 of the thesis enumerated the five level 1 themes used in the thematic analysis of the unstructured interviews, and explained how one or two levels of sub-themes were embedded in four of the five level 1 themes. Appendix D1 identified and defined the level 1, level 2 and level 3 themes. This appendix provides examples of how I applied the various themes and sub-themes to the coding of the interview texts.

For example, in theme T1, nature of technology (NAT TECH), there are six level 2 themes. They are automating capacity, complexity, propensity to innovation, quantity of technology, degree of uncertainty (using the standardised-customised continuum), and variability (using the routineness-variability continuum). The third level coding adds the dimension of the

strength of the level 2 factors (ie. low, moderate, or high). Hence, for example, when a level 3 code (eg. LO = low) is applied to the concatenated level 1 and level 2 codes for degree of automation (code: AUTO), a low level of automation capacity would be coded as NAT TECH_AUTO_LO.

The goals of the technologies (TECH GOAL) theme T2 had eight level 2 themes (eg. task fragmentation, cost-efficiency, productivity, quality of care, and quality of work life), most of which were explicitly explored in the interviews with the managers and procedural specialists.

For theme T3, nature of work, two level 2 themes were identified mainly to separate those chunks of text that referred to technological factors changing work characteristics, and those that described other characteristics of OTS work.

For theme T4, volume of work (VOL WORK), level 2 specifies the "direction" (ie. decrease, static, increase) of changes in the volume of work. The level 3 themes then identify the factors that the informant attributed with the changes in the volume of work. For example, (i) a decrease in the volume of work attributed to the technical characteristics of new technologies would be coded VOL WORK_DEC_TECHNOL; (ii) an increase in volume of work attributed to increased manual handling following new technology adoption would be coded VOL WORK_INC_MANUAL; and (iii) an increase in the volume of work attributed to other causes would be coded VOL WORK_INC_OTHER. In the latter case of other causes of changes in the volume of work, the same method as I now describe for T5 was used.

Theme T5 had no subordinate themes. The HyperRESEARCH™ software (described in Section 4.7.8 and Appendix D3) was used only to facilitate the level 1 coding of chunks of text which were subsequently collated by the software according to each of the three themes, and hardcopies printed. I subsequently read and re-read each of these collections of identically coded chunks of text in order to induce what were the emergent themes.

Appendix D3

Method of text coding of themes using the HyperRESEARCH™ computer software

HyperRESEARCH™ version 1.65 computer software is described by its producer, Research Ware Inc, Randolph MA, USA, as a 'content analysis tool for the qualitative researcher'. I have used this software in a *Microsoft Windows NT™* environment to undertake the analysis of the interviews in this research. It is described as allowing the researcher to (Research Ware 1997, 1-1):

- Code any amount of data any number of times
- Retrieve and manipulate portions of coded source material
- Test propositions about the data on any code or combination of codes using Boolean searches
- Test hypotheses about the overall meaning of (their) data using artificial intelligence
- Print or export the retrieved data to a word processor, spreadsheet, or statistical package for more in-depth analysis.

Several of its features persuaded me to use it as a tool to code and collate the coded interview data. First, it gave me the option to analyse the data with or without an *a priori* set of themes, as well as the capacity to run automated searches of any selection of interviews using synonyms of key words. Secondly, it was relatively uncomplicated to set up and use, it captured and coded only the chunks of selected text (as opposed to the full sentence or paragraph(s) containing the selected text), was very computer keystroke-efficient when coding, and yet sufficiently powerful for the task. Importantly, I was in control of the coding decisions just as I would have been using techniques described by Miles and Huberman (1994) and others in relation to the use of coding cards, multi-coloured highlighter pens and comments in the margins of printed text. However, the power of the software was that once the coding was completed, the software produced any reports I wanted.

Prior to coding interview data, every MS Word™ interview file needed to be divided into chunks of data of less than 16,000 characters in size (ie. less than 3,000 words) using the tilde (~) character as a separator, and then saved in .txt format (which also served as a backup copy of each interview file). This made it possible for HyperRESEARCH™ to "handle" the volume of text and whenever the interview text was opened within HyperRESEARCH™, the source text was divided into pages commencing at each tilde character. Most interviews were four HyperRESEARCH™ pages.

Once coding an interview was commenced, no editing of the original interview transcript was possible (without re-coding the interview from scratch) because the software identifies coded text by its beginning and ending character positions in the page. Changes in the source files after coding would result in the wrong chunks of text being identified. Hence, member checking had to be completed before analysis of an interview could commence.

Because I had originally coded all operating theatre services staff using the *X*** identifier, it was necessary for me to identify which interviews were with operating suite (ie. theatre) nurses and which ones were with sterilising technical aides. I renamed their source .txt files respectively as *X***_T or *X***_S so that interviews from each group were readily identifiable. Furthermore, in order to make hypothesis testing (if necessary) and reporting satisfy my particular needs, I sorted interview source files into eight individual HyperRESEARCH™ *studies*: STER.hrs containing all sterilising department interviews; SHSM.hrs for senior health service (executive) managers; DOCTORS.hrs; and five *studies* for operating suite nurses – one for each hospital (eg. A_XT.hrs). This was principally because a design characteristic of HyperRESEARCH™ is, for example, that when an hypothesis test is run, it will report on all source documents in a specific *study*. Had I stored all interviews in a single *study*, tests would be inappropriately performed on three of the four informant categories on each query.

Coding, although a time-consuming process, is functionally simple in HyperRESEARCH™, and all the more so because of the deductive approach that I applied to the analysis of the unstructured interviews. This meant that prior to commencing coding, I could enter all of the possible codes (eg. VOL WORK_DEC, VOL WORK_STAT, VOL WORK_INC_TECH_MAN, …..) into the *master code list*.

HyperRESEARCH™ was used on demand to count the occurrences in each interview of any codes. This was fundamental to one of the main forms of analysis of interview data, which was to tabulate a frequency distribution of the themes (codes) in order to "get a feel for" the general pattern of the data and draw some interim conclusions. Using "dummy" data only, the format is presented in the table following, where the number of asterisks indicates the number of chunks of text in each interview that were coded thus. This technique is conceptually similar to a *data accounting sheet* explained by Miles and Huberman (1994:80-82), and the researcher can readily visualise the thematic fields where the weight of evidence is located. (This technique serves as a means of preventing the researcher from erroneously treating the data as frequency distributions.) For example, in columns 1 to 3 dealing with increased volume of work, it can be readily interpreted that the hypothetical informants made many more references to an increase in volume of work than they made to static or decreased volume of work. Furthermore, concerning manual work, it could be readily seen in the example how column 1, compared to columns 2 and 3 combined, provides a weight of evidence that the hypothetical informants attribute increases in volume of work to increased manual work (as a consequence of the adoption of new intra-operative artefacts).

Format for frequency distribution of coded chunks of text in interviews

Informant code	VOL WORK_INC_ MANUAL. Column 1	VOL WORK_STAT_ MANUAL. Column 2	VOL WORK_DEC_ MANUAL. Column 3	VOL WORK _INC_OTHER	etc
AX***_T	********		*	*****	
*X***_T	**********	**		**	
*X***_S	***	**		*	
:					
DX***_T	******			****	

After coding was completed, the *expression builder* facility in HyperRESEARCH™ would have allowed me to build *expressions* using codes from the Master Code List using the Boolean operators, AND, OR and/or NOT (Research Ware 1997, 2-45) for the purpose of *hypothesis/proposition testing*. Any number of expressions can be tested in conjunction with other *expressions* by linking them with the IF…THEN Boolean operators in a predetermined sequence dictated by the *causal logic* underpinning each proposition to be tested. HyperRESEARCH™ can report on every interview (ie. every *case*) in a *study*. If a *case* satisfies the conditions of all expressions (ie. the proposition), HyperRESEARCH™ reports "goal reached", meaning that the proposition has tested "true". However, if a *case* fails to satisfy the conditions of a proposition, it will be reported "false".

I had originally envisaged using the proposition testing facility of the HyperRESEARCH™ software, but after developing and testing several propositions I decided not to proceed in this way. I chose, rather, to derive my interim conclusions from the inductive analysis of the frequency of themes. The main reason for my decision not to test propositions this way derives from the way that HyperRESEARCH™ tests *expressions*. For example, an interview might have ten chunks of text coded with the same code, and one chunk coded with another, but if the expression had stipulated "AND NOT" the code of the latter, it would test "false". The human analyst can readily see the weight of evidence from the former and would likely conclude that a single occurrence of the latter is insufficient to negate the weight of evidence provided by the former. However, the software enacts a strict interpretation of the proposition testing rules predetermined by the researcher – rules that are unable to be designed to reflect such human logic.

Appendix D4

Analysis of *volume of work* theme in SD Technical Aides' interviews

Overall, the unstructured interviews with the seven technical aides explored their experiences of changes in their work between 1988 and 1998. Their interviews were analysed deductively with chunks of text being coded, first according to a key (ie. level 1) theme, and then appropriate sub-themes. For example, in the case of the level 1 theme, VOL WORK, the level 2 theme identified the direction of the change in the volume of work (INC, STAT, DEC), and the level 3 theme identified one of three possible sources of that change (ie. MANUAL, TECHNOL, OTHER).

The relative frequencies with which chunks of text were coded in each interview are represented in the *data accounting sheet* (Miles & Huberman 1994; explained in Appendix D3), shown in the table below, which provides a graphical display of the "patterns" in the data. All chunks of text in interviews with the seven SD technical aides that were coded with the VOL WORK theme are represented by an asterisk in the table. The dominance of textual references to *increased* volume of work is readily evident by visually comparing the content of the upper three rows in the table with the other six rows. Each of the upper three rows shows the relative frequencies of references by each informant to three specific causes of increased volume of work: (i) increased manual handling of instruments (VOL WORK_INC_MANUAL), (ii) changes in reprocessing standards or characteristics of the reprocessing technologies (these being the dominant themes in VOL WORK_INC_OTHER), and (iii) characteristics of the new technologies such as the increased number of instruments (VOL WORK_INC_TECHNOL).

Frequencies of themes on changes in the volume of work in sterilising departments, 1988 - 1998

CODE OF THEME	INFORMANTS						
	AX002	BX002	CX001	DX007	DX008	EX001	EX002
VOL WORK_INC_MANUAL	***	**	****	*****	****	**	***
VOL WORK_INC_OTHER	******	*	***	***	*	**	*
VOL WORK_INC_TECHNOL	*	****	**		*****	****	**
VOL WORK_STAT_MANUAL			*	*			
VOL WORK_STAT_OTHER							
VOL WORK_STAT_TECHNOL	**	**	*				
VOL WORK_DEC_MANUAL			*				
VOL WORK_DEC_OTHER		*					
VOL WORK_DEC_TECHNOL	****	****			*	*	

There are actually seventy-seven chunks of coded text represented in the data accounting sheet, 75 per cent (n=58) of which are coded as VOL WORK_INC, seven coded as VOL WORK_STAT, and another twelve coded as VOL WORK_DEC, representing references by informants to occasions when new intra-operative artefact adoption had resulted in some reduction in workload. Most instances of the latter related to MAS instruments adopted since 1988, but by reading the text surrounding the chunks of text coded in this way, it is revealed that the MAS instruments had originally been very "fiddly" and labour intensive to reprocess, but subsequent technical modifications made them easier and less labour intensive to reprocess, although they are still more labour intensive to reprocess than non-MAS instruments that can be washed and dried mechanically.

Appendix E

Definitions of key terms

Preamble

This collection of definitions is divided into three sets. The first set relates to aspects of operating theatre services. The second set contains terms that I have developed or applied a particular or limited meaning for the purposes of this thesis during the research process. The third relates to terms used in the management of the Australian health care system. Terms are alphabetically ordered in each set, and terms that are *italicised* within a definition are defined elsewhere in this Appendix.

(1) Operating Theatre Services' terminology

Terms such as *operating room* and others have different meanings in different contexts, so to avoid confusion, the following definitions apply throughout the present thesis. One important reason for the lack of uniform definitions across all hospitals is that the physical location and administrative structure of operating suite services, diagnostic and therapeutic endoscopic services, and sterilising services vary from hospital to hospital within NSW according to each hospital's age, size, geographic location, and designated role (ie. its level and scope of services which it is equipped to provide for the community).

Circulating nurse

An *operating suite nurse* who is a member of the *surgical team*. The circulating nurse is principally an assistant to the *instrument nurse* in the *operating room* during the pre-operative set-up, the *(intra-) operative* phase, and the post-operative evacuation of the *operating room*. During the *(intra-) operative* phase his/her key roles include providing support to the *operative team* as required (such as by fetching additional *intra-operative artefacts* on request), and completing much of the nursing documentation in the patient's medical record that is associated with the *procedure*.

Endoscopy Unit (EU)

A stand-alone unit dedicated to the provision of diagnostic and therapeutic gastro-intestinal and respiratory endoscopic services on an *inpatient* or *outpatient* basis, with the capacity to provide an holistic service from admission to discharge of patients on a day-only basis.

Instrument nurse

An *operating suite nurse* who is a member of the *operative team* whose key roles during the *operative* phase of *surgical production* are fourfold: (1) to ensure that all of the necessary *intra-operative artefacts* are assembled and functional immediately prior to a *procedure*; (2) to assist other members of the *operative team* during the course of the *procedure* as required; (3) to protect the "sterile field"; and (4) to ensure that all *intra-operative artefacts* can be accounted for at the conclusion of the *procedure*.

Intra-operative (or Operative)

The term refers to the operative phase of surgical production during which time the *procedure* is carried out on a patient.

Minimum Access Surgery (MAS)

Also known as Minimally Invasive Surgery (MIS) or "keyhole" surgery (Hirsch 1994:47); it is an operative technique that does not involve a conventional incision into a body cavity or the direct manual handling of the physical contents of that body cavity by the proceduralist. All minimum access surgery involves the procedure being carried out using video technologies to visualise the contents of the body cavity.

Operating Room (OR)

The actual room in which surgical procedures are performed on one patient at one time. The room is equipped with fixed overhead operating lights, operating table, anaesthetic machine, patient monitoring equipment, wall outlets for suction, air and anaesthetic gas supplies, and miscellaneous equipment. *Surgical instruments, materials and equipment* dedicated to each *procedure* are brought into the operating room immediately prior to the *procedure* and removed immediately afterwards.

Operating Suite (OS)

This is a purpose-built facility which may be known as an "operating theatre suite", "the operating rooms", or "theatres". It is a collection of *operating rooms* (and possibly some *procedure rooms*) and other related rooms such as anaesthetic induction rooms, storage rooms, seminar/tutorial rooms, cleaning rooms, offices, staff dining and lounge rooms, and staff change rooms. Sterilising services and endoscopy services might be integrated physically and/or administratively with the *operating suite* or may be in separate *Sterilising Departments* or *Endoscopy Units*.

Operating suite nurse (OS nurse)

In this thesis, an operating suite nurse is any nurse working within the *operating suite* and/or in an integrated or stand-alone *endoscopy unit* in a hospital.

Operating Theatre Services (OTS)

The collection of *operating suite* services, endoscopy services and sterilising services, regardless of how they might be physically located or administratively structured within individual hospitals.

Operating theatre services (OTS) staff

All employees of a hospital who work in the *operating suite*, *sterilising department* and/or *endoscopy unit*, and are the direct human factors of production in *surgical production*. The present thesis focuses on the *operating suite nurses* and *sterilising department technical aides* who are involved in the *intra-operative* use, and/or *perioperative* management and maintenance of *intra-operative artefacts*.

Operative team

A group of clinical professionals who work collaboratively during the *operative* phase of *surgical production* to carry out a *procedure*. A typical operative team is a *procedural specialist*, a surgical assistant, and an *instrument nurse*.

Patient

In the present thesis, a patient is the individual upon whom a *procedure* is carried out.

Perioperative

The term refers to the phases of *surgical production* occurring both before and after the *operative* phase.

Post-operative

After the *operative* phase of a procedure

Pre-operative

Before the *operative* phase of a procedure

Procedural specialists

In this thesis, procedural specialists are specialist surgeons of all surgical specialties, specialist physicians who perform diagnostic and/or therapeutic endoscopy, and specialist radiologists. This is because gastro-intestinal (G.I.) endoscopy may be performed by both specialist general surgeons and specialist G.I. endoscopy physicians within an *operating suite* or an *endoscopy unit*, and because specialist radiologists are increasingly participants in diagnostic and therapeutic *procedures* within *operating suites* or in specially-designed *procedure rooms* in medical imaging departments. The

present thesis shows them to be the end-users of the intra-operative artefacts that are adopted for use in the operative phase of *surgical production*.

Procedures

In the present thesis, *procedures* refers to the invasive therapies or diagnostic tests, including conventional surgery, that are usually performed under some form of anaesthesia in an *operating room* or a *procedure room* of an *operating suite* in a hospital. eg. a total knee replacement, cholecystectomy, or colonoscopy.

Procedure Room (PR)

The actual room in which minor surgical *procedure*s or endoscopic *procedures* are performed on one patient at one time. The room is usually not equipped with overhead operating lights or a conventional operating table, nor with the same volume and/or level of other equipment that is standard in an *operating room*. *Procedures* undertaken in *procedure rooms* are often performed on the patient's dedicated hospital bed/trolley.

Sterilising Department (SD)

A department dedicated to the provision of sterilising services to clinical departments within a hospital, but predominantly to the *operating suite*. Various functional arrangements of sterilising services exist within New South Wales's hospitals, from Central Sterilising Units which provide services to all clinical departments in more than one hospital within a geographical area, to sterilising units that are dedicated to providing services to the *operating suites* in which they are physically and administratively located.

Surgical team

A group of clinical professionals who work collaboratively during the *operative* phase of *surgical production* to facilitate or carry out a *procedure* on a *patient*. A typical surgical team is the *operative team* plus an anaesthetist and a *circulating nurse*. Other personnel such as assistants to anaesthetists, radiologists, and perfusionists are members of surgical teams for certain types of *procedure*s.

Technical Aide

In this thesis, this is a generic term to describe any person whose principal role it is to undertake the perioperative processing (eg. cleaning, checking, assembly, wrapping, and sterilisation) of *surgical instruments*.

(2) New or specified terms

Ancillaries

Customarily single use items used during the course of a *procedure* that are categorically not any other type of *surgical materials*. eg. swabs, sponges, syringes, suction devices, irrigation catheters. (Based on "ancillary" defined by *The Macquarie Dictionary* (1997) as 'a subsidiary or helping thing'.)

Artefact

'An object made by humans with a view to subsequent use' (*The Macquarie Dictionary* 1997).

Enabling equipment

Any mechanical or electronic device employed under the control of one or more members of the *surgical team* during the *operative* phase of *surgical production*. Enabling equipment is usually used in conjunction with specific *surgical instruments*.

Equipment

'Anything used in or provided for equipping' where "to equip" means 'to furnish or provide with whatever is needed for services or for any undertaking' (*The Macquarie Dictionary* 1997). In the present thesis, *equipment* is categorically an *artefact*.

Intra-operative artefact

Any tangible (physical) thing (ie. artefact) employed in the *operative* phase of *surgical production*.

Intra-operative techniques

The knowledge, skills and methods employed in the *operative* phase of *surgical production*.

Intra-operative technologies

All types of technologies (*artefacts*, techniques and organisation) employed in the *operative* phase of *surgical production*.

Inventory

'A detailed descriptive list of articles with number, quantity and value of each' (*The Macquarie Dictionary* 1997).

Item

'Separate article or particular' (*The Macquarie Dictionary* 1997); a physical "thing".

Manipulate

'To handle, manage, or use, especially with skill, in some process of treatment or performance' (*The Macquarie Dictionary* 1997). From *manus* (Latin), "hand": Hence, "to use by hand".

Materials

'Articles of any kind requisite for making or doing something' (*The Macquarie Dictionary* 1997).

Patient *in situ* items

Items that are left post-operatively, usually temporarily, in a *patient*, for therapeutic, non-prosthetic purposes. eg. urinary catheters, wound drains, sutures, surgical staples.

Perioperative artefacts

Any tangible thing (ie. artefact) employed in the *perioperative* phase of *surgical production*.

Perioperative techniques

The knowledge, skills and methods employed in the *perioperative* phase of *surgical production*.

Perioperative technologies

All types of technologies (artefacts, techniques and organisation) employed in the *perioperative* phase of *surgical production*.

Produce

'To bring into existence' (*The Macquarie Dictionary* 1997).

Prostheses

Permanent and semi-permanent implanted items; 'artificial parts to supply defects of the body' (*The Macquarie Dictionary* 1997). eg. cardiac pacemaker, knee joint, intra-ocular lens, vascular grafts. This definition permits the inclusion of items that are not typically categorised as prostheses in medical practice. For example, a cardiac pacemaker is not a substitute for a heart, in the way that an artificial knee joint replaces a damaged knee joint. However, both are intended to be retained in the body to remedy some physically defect, which, in the case of a cardiac pacemaker, is to correct cardiac arrhythmia on a continuous basis.

Surgical instruments

Artefacts manipulated by any member of the *operative team* during the *operative* phase of *surgical production*.

Surgical materials

Articles of any kind (exclusive of *surgical instruments*) that are manipulated by any member of the *operative team* during the *operative* phase of *surgical production*. They are categorically *prostheses, patient in situ items*, and *ancillaries*.

Surgical production

The bundle of activities undertaken before, during, and after procedures within a hospital's operating theatre services that relate to the use, management, and maintenance of intra-operative artefacts and the associated perioperative technologies. Contributors to these activities are the procedural specialists and the operating theatre services staff.

Surgical Technologies

All types of technologies (artefacts, techniques and organisation) employed in the *intra-operative* or *perioperative* phases of *surgical production*.

Total human labour input (THLI) to surgical production

The sum of the *intraoperative* and *perioperative* human labour input to producing a specific *procedure*, but limited in this thesis to the labour of *operating suite nurses* and *sterilising department technical aides* who are hospital employees working in *operating theatre services.*

(3) Terms used in the management of health services

Acute (care) hospital

'An establishment which provides at least minimal medical, surgical or obstetric services for inpatient treatment and/or care, with round-the-clock qualified nursing and other professional services' (Productivity Commission 1999:vii).

Average available beds

'A weighted average of available beds at the end of each month in a period. Allowance is made for low demand over holiday periods' (NSW Health 1990:31).

Average length of stay

'The average number of days each inpatient stays in hospital for each episode of care. Also referred to as average stay. The formula is ALOS = total inpatient bed days for the year divided by the number of *inpatients* treated in year' (NSW Health 1990:32).

Available beds

'The number of beds in a hospital or Area Health Service which were resourced with services and staff and which were routinely available for use at 30 June' (NSW Health 1990:31).

Casemix

'The mix and types of patients treated by a hospital according to their medical conditions. Casemix is often described with reference to Diagnostic Related Groups' (Productivity Commission 1999:vii).

Casemix index

A numerical measure of the assortment of patient cases treated by a given hospital, so that a higher value indicates a greater average degree of complexity of cases (Fottler et al. 1993:672). It is the calculated mean case weight of all patients treated in a given period (usually one year).

Casemix payment system

A hospital funding system that links hospital reimbursement to outputs based on patient classification

Case (or cost) weight

Based on a national average cost per episode of hospital care being the standard case (or cost) weight of 1, the case weight of any other case type (identified by DRG) is given as the total estimated cost of that case relative to the national average cost per episode of care. For example, in 1997/98, the National public hospital average cost per DRG was $2,412 which was represented by a cost weight = 1, and AR-DRG v.4.0 code N10Z (Diagnostic Curettage with or without Diagnostic Hysteroscopy) had a cost weight = 0.37 representing a cost in 1997/98 of $882 (or 37% of $2,412). The underlying assumption is that the higher the total cost, the higher the case weight, and the higher the case complexity and/or resources consumed in its production.

Day only admissions

'*Inpatients* who are admitted and separated on the same calendar day' (NSW Health 1990:32).

Diagnostic Related Groups (DRGs)

'A set of case types [that] identify patients with similar conditions and processes of care' (Fottler et al. 1993:673); a system of classifying 'acute *inpatients* who are clinically similar and who are expected, on average, to have similar costs of care and treatment' (Picone et al. 1993:26). Progressive refinements in case type classification is making it possible to improve the quality of estimates of the costs of all the inputs to individual case types uniquely identified by DRG and hence improved estimates of the actual cost per episode of inpatient care per DRG (see Fetter 1999).

Inpatients

'Patients who are formally admitted to a hospital or Area Health Service for care and/or treatment excluding new born babies who do not qualify as inpatients' (NSW Health 1990:32)

National Operating Room Service Weight (NORSW)

Similar to *case (or cost) weight*, but a weight per DRG based on the standard weight of 1 representing the national average cost of a surgical procedure within an *operating theatre service*, the cost of which is a component of the case weight of a specific DRG. Hence, OR service weights represent the average relative use of *operating theatre service* resources for each inpatient episode by the patients in each DRG (Commonwealth Department of Human Services and Health 1995a:2). For example, in 1997/98, the Australian National public hospital average OR service weight cost per DRG was $913, which was represented by a service weight = 1.

Outpatients

Patients receiving a service within a hospital or Area Health Service who are not formally admitted for that care and/or treatment.

Separation

A formal process whereby an *inpatient* leaves hospital at the end of an episode of care, and includes discharge, transfer to another institution and death (Commonwealth Department of Human Services and Health 1995b:8).

Surgical throughput

The number of *patients* having *procedures* carried out in a given time period in a hospital's *operating theatre service*; often expressed as average throughput per day.