Appendix 1. Scribe utilisation cost-benefit analysis

Although our study was primarily aimed at assessing productivity gains from the use of scribes in emergency departments (EDs), analysis of cost and benefit may be more important for the future of this role. A large number of variables, often site-specific, influence this analysis and certainty regarding cost and benefit is very difficult to achieve. Below is an example cost-benefit analysis for Cabrini with the assumptions underpinning it clearly outlined.

It would be incumbent on service administrators to generate a local business case based on local costs. The following validated metrics can be used in the creation of any local business case to determine potential local viability.

- **Cost of training per scribe: USD$5015 per scribe(1)**
- **Physician productivity gain per hour: 15%**
- **Time in ED improvement with scribes: 19 minutes**
- **The physician productivity gain is independent to the throughput gain of 19 minutes**

In terms of costs per hour of scribes and emergency physicians we have decided to generate an "average cost per hour" of each to use in a cost benefit analysis. All Australian to US dollar conversions are based on a 1.44 conversion rate(2).

Intrinsic to this analysis are a number of assumptions regarding the fixed and variable costs of a scribe program:

Training cost assumptions

- Training costs are fixed costs and their proportional contribution to the cost of the program decreases the more shifts the scribe works. In a conservative estimate, each trained scribe will work an average of 1000 hours for his or her whole scribe career (two, eight hour shifts per week for 52 weeks). Individual variation will occur.
- Cost to a hospital of training a single scribe using the training methods described in this study has been previously published(1). A 6% increase in the costs has been factored in (to the USD $5015) to account for wage indexation in Australia since costs were published.
- Given USD$5015(1) cost to train a scribe for 1000 hours work, this generates an additional USD$5 per hour in costs.
- Employers may choose to fund, part fund or fully recuperate the costs of training scribes.

Wage assumptions

- Average scribe wage per hour is based on a USD$16.86 per hour rate, with an evening 15% loading and a weekend 50% loading. This generates an average per hour cost of USD$20.51.
- Average emergency physician cost per hour is USD$165 based on the same in and out of hours' distribution of shifts and loadings of 130% for evenings and 150% for weekends.
- Scribes and emergency physicians are evenly deployed across weekday, evening and weekend shifts.
- Nights and public holidays are excluded from this analysis.
- All hourly rates include 25% of 'on-costs' which includes annual leave, sick leave, long service leave, pension contributions and work injury insurance. (Public health insurance is universal in Australia and not a cost to the employer).

Cost of ED operations: assumptions and calculations

- Revenue per patient is unchanged. If working in a location where revenue is in any way related to medical notes content, then scribes will likely generate increased revenue as demonstrated in other settings for adult patients(3-5). This revenue uplift has not been accounted for in this cost benefit analysis and per-patient revenue was not evaluated in this study.
- No costs of harms or prevention of harms caused by the presence (or absence) of the scribe have been calculated.
- Start-up costs of purchasing computers-on-wheels have been excluded from this analysis. If a department doesn't already have these, there will be extra costs of around USD$2,220 per unit, which could be used for 14 scribed shifts per week per unit (computer and trolley)(1).
- Cost per cubicle hour is generated by total ED costs divided by total staffed cubicle hours. Cabrini was utilized in this analysis generating a figure of $64.2US. (Cost per cubicle hour will vary between institutions).
- Emergency Physicians see 1.31 patients per hour with a scribe with each patient staying 19 minutes less in the department. Therefore the cubicle cost saving per scribed hour is 1.31 * 0.32hr (19 minutes) * USD$64.20 = USD$26.91 savings per scribed hour. This assumes steady demand on cubicle space.
- Physician hours saved by increased productivity is calculated by 15% (the determined productivity gain) divided by US$165.

Total costs and savings

Costs or savings in USD per scribed hour	With training absorbed by site	50% training absorbed by site 50% by scribe	100% training absorbed by scribe
Scribe costs	(20.51)	(20.51)	(20.51)
Training cost	(5.00)	(2.50)	0
Cubicle costs saved	26.91	26.91	26.91
Physician costs saved	24.75 (15% of US $165)	24.75	24.75
Total USD costs saved per scribed hour	**+26.15**	**+28.65**	**+31.15**

Summary

Accepting the assumptions outlined, this analysis demonstrates a saving of USD$26.15 per scribed hour and a strong business case for scribe utilisation in the ED. When additional qualitative benefits are considered, such as improvements to emergency physician job satisfaction and potential increased revenue opportunity with scribed notes, the case becomes stronger.

This is based on an ED being able to realise the value of the saved 19 minutes either by increased revenue from additional patients seen or improved efficiency and time-based performance indicator improvements. If this 19 minutes efficiency realisation is not achieved the case for utilisation of scribes is there if the scribe pays > 20% of their training costs.

Our recommendation is that all sites with EDs experiencing high demand and growth in demand conduct their own cost-benefit analysis and consider a scribe program to improve emergency physician productivity and experience and ED throughput.

References

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Appendix 2. Individual site patient demographics

Austin (public, tertiary)	Non-scribed	Scribed
Total Patients	4,783	1,353
Male (n, %)†	2,327, 50%	709, 52%
Age, Mean (SD)†	47.9 (26.0)	49.6 (25.6)
(95%CI)	(47.7 to 48.1)	(49.4 to 49.8)
Triage (n, %)†		
Category 1	33, 1%	6, 0%
Category 2	965, 20%	242, 18%
Category 3	2,019, 42%	551, 41%
Category 4	1,462, 31%	450, 33%
Category 5	304, 6%	104, 8%
Admissions (n, %)†	1,062, 22%	302, 22%
Bendigo (public, regional referral)		
Total Patients	3,545	720
Male (n, %)†	1,764, 50%	342, 48%
Age, Mean (SD)†	43.6 (27.2)	40.9 (26.9)
(95%CI)	(43.3 to 43.8)	(40.7 to 41.2)
Triage (n, %)†		
Category 1	74, 2%	7, 1%
Category 2	850, 24%	130, 18%
Category 3	1,380, 39%	281, 39%
Category 4	1,097, 31%	259, 36%
Category 5	144, 4%	43, 6%
Admissions (n, %)*	894, 25%	138, 20%
Cabrini (not-for-profit, tertiary)		
Total Patients	7,427	1,277
Male (n, %)†	3,285, 44%	612, 48%
Age, Mean (SD)†	57.6 (28.4)	57.1 (28.2)
(95%CI)	(57.4 to 57.9)	(56.9 to 57.3)
Triage (n, %)†		
Category 1	19, 0%	0, 0%
Category 2	795, 11%	136, 11%
Category 3	3,392, 46%	590, 46%
Category 4	2,729, 37%	492, 39%
Category 5	492, 7%	59, 5%
Admissions (n, %)†	4,126, 56%	717, 56%
Dandenong (public, metropolitan)		
Total Patients	4,778	853
Male (n, %)†	2,590, 54%	460, 54%
Age, Mean (SD)†	40.8 (25.0)	40.9 (26.2)
(95%CI)	(40.6 to	(40.6 to

	41.1)	41.1)
Triage (n, %)†		
Category 1	49, 1%	6, 1%
Category 2	863, 18%	156, 18%
Category 3	1,911, 40%	309, 36%
Category 4	1,676, 35%	325, 38%
Category 5	279, 6%	57, 7%
Admissions (n, %)†	1,269, 27%	219, 26%
Monash (public, tertiary, paediatric)		
Total Patients	3,305	895
Male (n, %)†	1,850, 56%	504, 56%
Age, Mean (SD)†	6.2 (5.7)	6.3 (6.5)
(95%CI)	(6.0 to 6.3)	(6.1 to 6.4)
Triage (n, %)†		
Category 1	12, 0%	1, 0%
Category 2	544, 16%	131, 15%
Category 3	1,441, 44%	407, 45%
Category 4	1,099, 33%	299, 33%
Category 5	209, 6%	57, 6%
Admissions (n, %)†	391, 12%	105, 12%

*p<0.05 - statistically significant difference

†p >0.05 - no statistically significant difference

Appendix 3. Individual site productivity and throughput data

Austin (public, tertiary)	Non-scribed	Scribed	Absolute differences
Total Shifts	495	109	
Mean Primary patients/hour/doctor*	1.25	1.56	0.31 increase
95% CI	(1.15 to 1.34)	(1.28 to 1.84)	(0.04, 0.55)
Mean total patients/hour/doctor*	1.78	1.99	0.20 increase
95% CI	(1.69 to 1.87)	(1.72 to 2.26)	(-0.03, 0.44)
Median door-to-doctor (min)*	58	50	8 min
(Interquartile range)	(14 to 84)	(12 to 71)	reduction
Median length of stay (min)*	213.6	193.4	20 min
(Interquartile range)	(97 to 273)	(85 to 255)	reduction
Bendigo (public, regional referral)			
Total Shifts	647	102	
Mean Primary patients/hour/doctor*	0.63	1.01	0.38 increase
95% CI	(0.0.59 to 0.67)	(0.86 to 1.15)	(0.25,0.50)
Mean total patients/hour/doctor*	0.74	1.08	0.33 increase
95% CI	(0.0.70 to 0.79)	(0.93 to 1.22)	(0.21, 0.46)
Door-to-doctor (min)†	69	72	3 minute
(Interquartile range)	(16 to 97)	(20 to 99)	increase
Length of stay (min)*	265	235	31 minute
(Interquartile range)	(118 to 340)	(115 to 300)	reduction
Cabrini (not-for-profit, tertiary)			
Total Shifts	1108	163	
Mean Primary patients/hour/doctor*	0.82	0.93	0.11 increase
95% CI	(0.80 to 0.84)	(0.89 to 0.97)	(0.06, 0.17)
Total patients/hour/doctor*	1.04	1.14	0.09 increase
95% CI	(1.02 to 1.07)	(1.09 to 1.18)	(0.03, 0.16)
Door-to-doctor (min)†	41	43	2 minute
(Interquartile range)	(8 to 49)	(9 to 52)	increase
Length of stay (min)*	313	285.0	28 minute
(Interquartile range)	(162 to 373)	(162 to 348)	reduction
Dandenong (public, metropolitan)			
Total Shifts	580	110	
Mean Primary patients/hour/doctor†	0.81	0.87	0.05 increase
95% CI	(0.0.77 to 0.85)	(0.78 to 0.95)	(-0.04, 0.15)
Mean total patients/hour/doctor†	1.21	1.19	0.02 reduction
95% CI	(1.17 to 1.25)	(1.10 to 1.29)	(-0.12, 0.09)
Door-to-doctor (min)*	44	38	6 minute
(Interquartile range)	(12 to 66)	(10 to 56)	reduction
Length of stay (min)*	245	210	35 minute
(Interquartile range)	(99 to 260)	(90 to 235)	reduction
Monash (public, tertiary, paediatric)			

Total Shifts	466	105	
Mean Primary patients/hour/doctor*	0.73	0.91	0.18 increase
95% CI	(0.70 to 0.76)	(0.81 to 1.00)	(0.10, 0.26)
Mean total patients/hour/doctor*	1.11	1.25	0.14 increase
95% CI	(1.1.08 to 1.15)	(1.15 to 1.35)	(0.04, 0.23)
Door-to-doctor (min)†	48	45	3 minute reduction
(Interquartile range)	(13 to 69)	(14 to 66)	
Length of stay (min)*	174	154	20 minute reduction
(Interquartile range)	(73 to 190)	(65 to 171)	

*p<0.05 - statistically significant difference

†p >0.05 - no statistically significant difference