

HOSPITAL IN THE HOME DEVELOPMENT PROJECT

Development of Victorian Disease-Specific Guidelines for Hospital in the Home (HITH)

FINAL REPORT

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on behalf of all participating centres

Aims and Objectives:

1. To develop guidelines which outline those medical conditions (as defined by ICD9 code) which are suitable to be treated by HITH from a clinical and financial perspective.
2. Identify conditions which should not be treated by HITH due to either the potential for excess risk for poor clinical outcome or financial inefficiency.
3. To undertake a sensitivity analysis of the potential risk of poor outcome versus benefits of HITH for various medical conditions.

Methods

Review of the clinical outcome of HITH patients managed at 4 sites (Monash Medical Centre, Dandenong Hospital, Mornington Peninsula (Frankston) Hospital and Geelong Hospital) was undertaken during a 2.5 year period.

Four clinical HITH Programs were reviewed:

- Intravenous Antibiotic Program (all 4 sites)
- Low-molecular weight (LMW) Heparin Anticoagulation Program (all 4 sites)
- Post-cardiac Surgery Discharge Program (Monash Medical Centre)
- Wound Management Program (Geelong Hospital)

The study commenced in January 1998 with the prospective assessment of HITH patients for a 15 months period. In addition, the clinical records of all HITH patients managed by the four Treatment Programs during the 15 months prior to January 1998 were retrospectively reviewed by one of two Research Nurses. The retrospective review was undertaken in a very standardized, consistent manner. Thus, the 30 month study period consisted of 15 months retrospective and 15 months prospective assessment. Although the initial Study protocol had called for 18 months retrospective and prospective assessment (ie 36 months total), this could not be undertaken with accuracy due to difficulties with Medical Records availability. Hence it was decided to limit the Study period to a 30 month time period that allowed for most accurate data assessment.

The following details were analysed:

1. Patient demographic and social features
2. Total duration of therapy (including in-hospital and HITH care)
3. Readmission rate
4. Complication rate - including rates of line sepsis, bacteraemia, toxicity associated with antibiotic and fragmin therapy (as measured by laboratory markers and clinical description)
5. Cure rate
6. Mortality

Outcomes Definitions

The following definitions were used:

Successful outcomes:

- Expected HITH outcome achieved with no interruption
- Expected HITH outcome achieved with no interruption, but patient left with some minor symptoms (generally poorly defined and not related to the reason for HITH treatment)
- Expected HITH outcome achieved, but with a planned interruption
- Expected HITH outcome achieved, but with an unplanned interruption, following which the patient successfully completed HITH therapy

Unsuccessful outcomes (HITH failures):

- Unplanned cessation of HITH requiring transfer to an inpatient bed
- Expected HITH outcome not achieved, after an unplanned interruption and unsuccessful return to HITH therapy

Indeterminate:

- Unplanned cessation of HITH for reasons unrelated to the patient's medical condition, or due to special circumstances such as poor patient compliance with HITH therapy

These definitions were devised since the initial plan to use simple outcomes definitions such as "cure" and "failure" were found to be frequently inappropriate for conditions where the HITH therapy was not expected to result in a cure. For example: Anticoagulation was frequently not expected to be curative, but simply to be one component of the patients' care. Similarly some antibiotic therapy was not expected to be curative, but was to allow the patient to improve sufficiently as to be changed from intravenous to oral antibiotic therapy. The use of the above Outcomes Definitions proved to be very robust across all four HITH Programs assessed.

Results

The Outcomes Study assessed 2,714 treatment episodes in 2,549 patients during the 30 month study period. A similar number of episodes were reviewed in both the retrospective and prospective assessments. A number of patients were treated on multiple occasions and in some cases, by more than one of the study programs

A summary of the entire Outcomes Study, including the number of treatment episodes per Program is shown in Table 1. Patient satisfaction with the various HITH Programs was excellent (data not shown). Results are best described by HITH Program.

1. Intravenous Antibiotic Program

This Program treated the vast majority of the episodes assessed in this Study. Basic demographic data are shown in Table 2. The study reviewed 1576 patients who received 1686 episodes of HITH treatment. Approximately equal numbers of patients were treated at all four sites.

Table 3 demonstrates the clinical outcome of treatment episodes. The overall outcomes of the 1677 evaluable and 9 indeterminate patients were: 1575/1677 (93.9%) achieved the expected outcome and 102/1677 (6.1%) could be considered HITH failures. Cellulitis, pneumonia, pyelonephritis and osteomyelitis were the most frequently treated diseases. All diseases had good outcomes. Some of the more difficult-to-treat diseases such as osteomyelitis and endocarditis had HITH failure rates of about 15%, but these were extremely comparable with the published treatment failure rate for patients with the same diseases managed entirely in hospital. Thus, patients managed by a HITH IV Antibiotic Program for these conditions have a near identical outcome to similar patients managed entirely in hospital.

Clinically important findings are revealed by a breakdown of the outcomes of various diseases by treatment site. Table 4 demonstrates the site-specific findings for the five diseases most commonly treated by HITH IV Antibiotic Programs.

Cellulitis and pneumonia are notable for the fact that patients with these conditions had significantly ($p < 0.001$ and $p = 0.001$, respectively) worse clinical outcomes if they were managed by the HITH Program at Dandenong Hospital. These differences could not be explained by differences in patient co-morbidities. Instead these differences appeared to be almost entirely among patients admitted direct to the Dandenong HITH Program from the Emergency Department. Careful review of each patient's Hospital Record suggested that the rigor of the process for assessing suitability for enrolment onto the HITH Program was inappropriate in the Dandenong Emergency Department.

In particular, the findings for pneumonia are consistent with anecdotal clinician opinion at Dandenong Hospital that HITH treatment outcomes were poor. Subsequently, but prior to this Study's findings, the Dandenong HITH Program became managed directly by Monash Medical Centre as part of the re-structure of clinical care associated with the establishment of the Southern Health Care Network. Unfortunately, no data are available to assess whether this change in management (and treatment protocols) has

altered clinical outcomes for these diseases. However, anecdotal information suggests this to be the case. These examples demonstrate the potential clinical value of undertaking outcomes analysis in this manner.

Adverse events are an important component of any outcomes assessment. Adverse reactions were infrequent, being reported by 7.1% of patients managed by IV Antibiotic Programs (Table 5). Rarely were adverse reactions sufficiently severe as to require cessation of antibiotic therapy. Nausea and vomiting were the most commonly reported adverse reactions. Notable was the relatively low rate of both hepatotoxicity and nephrotoxicity.

2. LMW Heparin Program

LMW Heparin Programs at the 4 participating sites treated 549 patients for 579 episodes. Basic demographic data are shown in Table 6. Monash Medical Centre and Geelong Hospital managed the largest number of episodes.

Clinical outcomes are shown in Table 7. Only 19 of 526 (3.6%) episodes did not achieve the expected outcomes and could be considered HITH failures. No substantive complications were noted at any site. LMW heparin therapy appeared to be an extremely safe mode of therapy for a wide variety of indications.

3. Post-Cardiac Surgery Program

The Post-Cardiac Surgery Program was conducted only at Monash Medical Centre – 359 patients received 359 episodes of care. Mean HITH length of stay (LOS) was 2.3 (\pm 1.5) days, which together with patients' in-hospital stay was similar to the State average LOS for these conditions. Demographic data are shown in Table 8.

Clinical outcomes (Table 9) were excellent. Only 3 of the 359 episodes (0.8%) did not achieve the expected outcome. Two of these failures were related to wound or pressure sore infections; while the other patient was admitted with dyspnea related to poor cardiac function. With careful patient selection, this HITH Program appears to offer a very safe mode of therapy.

4. Wound Management Program

A co-ordinated Wound Management Program was offered primarily at Geelong Hospital, hence this was the only site that was assessed. Eighty-eight patients received 90 treatment episodes. Demographic data are shown in Table 10. Most patients had complex post-surgical wounds.

Clinical outcomes are shown in Table 11. The expected HITH clinical outcome was not achieved in 5 patients (5.6%). These patients had sufficiently slow progress that admission to hospital, generally for enforced bed rest, was required. For appropriately selected patients, this Program appeared to be very successful and safe.

Conclusions

The HITH Outcomes Study provides the first large assessment of HITH outcomes in Australia. These data set the benchmark for expected clinical outcomes for HITH patients treated with IV antibiotics, LMW heparin anticoagulation, post-cardiac surgery care and wound care. The outcome findings are notable, since they compare very favorably with the very limited published data from the USA. Furthermore, for difficult-to-treat conditions such as osteomyelitis, endocarditis and meningitis, outcomes were extremely comparable to published outcomes for patients managed entirely in hospital.

The Outcomes Study also proved useful in identifying some important differences in outcomes between treatment sites. The differences in clinical outcome for patients managed at Dandenong Hospital with pneumonia had been suspected from anecdotal information. However, the fact that this Study statistically confirmed this impression has added weight to the need for change in HITH selection criteria at Dandenong for this condition. Of greater practical importance are the data regarding cellulitis, since the inferior outcomes at Dandenong were not suspected until this study was analysed. Subsequently, changes in selection criteria have also been instituted for patients presenting to the Emergency Department with cellulitis.

A number of issues that we had originally planned to examine in this Study were not assessed. Costing analyses of HITH care and treatment failures could not be undertaken due to limitations within the Finance Departments at all the Study sites. However, some very relevant financial data was assessed at Monash Medical Centre as part of the DHS Sustainability Study completed recently. Secondly, it was planned to examine, in detail, the various co-morbidities that may be associated with poor HITH clinical outcomes. However, the extremely low rate of unsatisfactory outcomes limited the value of this analysis both clinically and statistically. Similarly, a sensitivity analysis could not be undertaken due to the low rate of poor outcomes.

This study suggests that all conditions assessed could be managed by a HITH Program with the expectation of excellent safety and clinical efficacy. No conditions managed by HITH Programs were identified as being inappropriate for HITH care. Most notable, however, was the value of the study in identifying areas of outcome difference between some institutions that led to changes being made in clinical practice management to improve patient care at these sites.

Further outcomes studies would be worthwhile. Indeed, an expectation that all HITH treatment sites should be expected to collect at least basic outcomes data for their patients would be both reasonable and potentially useful in improving future HITH care.

Participating Centres:

1. Monash Medical Centre

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Dept. and Hospital in the Home Unit

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2. Mornington Peninsula Hospital - Frankston

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3. Dandenong & District Hospital

Dr. Johannes Wenzel

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4. Geelong Hospital

Dr. Malcolm McDonald

Physician, Hospital in the Home Unit

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Nurse Co-ordinator, Hospital in the Home Unit

Table 1**HITH Outcomes Study****Summary of Study Episodes**

n = 2714 episodes; 2549 patients

Program	Total episodes (Retrospective/Prospective)	MMC (Retro/Prospec)	Dandenong (Retro/Prospec)	Frankston (Retro/Prospec)	Geelong (Retro/Prospec)
IV Antibiotic Program	1686 (880/806)	300 (159/141)	474 (252/222)	505 (279/226)	407 (190/217)
LMW Heparin Program	579 (225/354)	175 (94/81)	95 (45/50)	119 (35/84)	190 (51/139)
Cardiac Program	359 (184/175)	359 (184/175)	- -	- -	- -
Wound Management Program	90 (65/25)	6 (0/6)	-	14 (6/8)	70 (59/11)

Table 2**IV Antibiotic Program****Demographic data**

	Overall (Retrospective/Prospective)	MMC (Retro/Prospec)	Dandenong (Retro/Prospec)	Frankston (Retro/Prospec)	Geelong (Retro/Prospec)
No. episodes	1686 (880/806)	300 (159/141)	474 (252/222)	505 (279/226)	407 (190/217)
No. patients	1576				
Age \pm SD years (n=1686; Range)	46.6 \pm 18.8 (13 – 93)				
Female	708				
Male	978				
Mean (\pm SD) length of HITH stay per episode (Range)	8.8 \pm 8.8 days (1 – 78 days)				
Number of episodes per patient:					
1 episode	1508				
2 episodes	53				
3 episodes	8				
4 episodes	4				
5 episodes	1				
7 episodes	1				
20 episodes	1				

Table 3**IV Antibiotic Program****Outcome Summary**

n = 1686 episodes; 1576 patients

Diagnosis	Total episodes	Outcome achieved				Outcome not achieved		Indeterminate: unplanned cessation; special circumstances
		Achieved with no interruption	Achieved with no interruption (but symptoms at completion)	Achieved after planned interruption	Achieved after unplanned interruption then return to HITH	Unplanned cessation with transfer to an inpatient bed	Not achieved after unplanned interruption then return to HITH	
Total	1686	1522	3	13	37	100	2	9
Cellulitis	782	716	-	2	12	49	-	3
Pneumonia	217	204	-	2	2	8	-	1
Pyelonephritis	146	135	1	-	2	5	-	3
Osteomyelitis	75	57	1	2	4	11	-	-
Septic arthritis:								
Undifferentiated	13	10	-	-	1	2	-	-
Native joint	13	11	-	-	1	1	-	-
Prosthetic joint	17	14	-	-	1	2	-	-
Endocarditis	34	20	-	6	3	4	1	-
Meningitis	23	22	-	-	1	-	-	-
Infected wounds:								
Surgical	44	39	-	1	4	-	-	-
Non-surgical	9	9	-	-	-	-	-	-

IV-line related infection	8	8	-	-	-	-	-	-	-
Septicaemia									
Undifferentiated	7	7	-	-	-	-	-	-	-
Proven bacteraemia	16	15	-	-	-	-	1	-	-

Table 3 continued:

Diagnosis	Total episodes	Outcome achieved				Outcome not achieved		Indeterminate: unplanned cessation; special circumstances
		Achieved with no interruption	Achieved with no interruption (but symptoms at completion)	Achieved after planned interruption	Achieved after unplanned interruption then return to HITH	Unplanned cessation with transfer to an inpatient bed	Not achieved after unplanned interruption then return to HITH	
CMV disease:								
HIV-related	9	7	-	-	-	2	-	-
Non-HIV-related	33*	30	-	-	1	2	-	-
Cystic fibrosis	7	6	1	-	-	-	-	-
Bronchiectasis	8	5	-	-	-	3	-	-
Non-pyelonephritis UTI	19	18	-	-	-	1	-	-
Epididymoorchitis	20	20	-	-	-	-	-	-
Pelvic inflammatory Disease	5	5	-	-	-	-	-	-
Syphilis	2	2	-	-	-	-	-	-
Bursitis	14	12	-	-	-	2	-	-
Head & neck infections	24	24	-	-	-	-	-	-
Miscellaneous	141	126	-	-	5	7	1	2

* One patient received 20 treatment episodes

Table 4

IV Antibiotic Program

Analysis of Clinical Treatment Failures for Common Diseases

Disease	Total episodes	Total evaluable episodes*	Outcome not achieved** (%)	Outcome not achieved/evaluable episodes per institution (%)				Reason(s) for Outcome not being achieved	Comment
				MMC	DDH	Frankston	Geelong		
Cellulitis	782	779	49 (6.3%)	5/119 (4.2%)	30/237 (12.7%)	4/188 (2.1%)	10/235 (4.3%)	42 Not resolving/ deterioration 2 Cardiac failure/chest pain 1 Pulmonary embolus 1 Collapse 1 Poor diabetic control 2 Not coping at home	Excess failures at Dandenong Hospital (P<0.001)
Pneumonia	217	216	8 (3.7%)	0/15 (0%)	8/85 (9.4%)	0/107 (0%)	0/9 (0%)	7 Deterioration 1 Cerebrovascular accident	Excess failures at Dandenong Hospital (P=0.001)
Pyelonephritis	146	143	5 (3.5%)	1/8 (0%)	3/79 (3.8%)	1/49 (2%)	0/7 (0%)	5 Not improving/deterioration	
Osteomyelitis	75	75	11 (14.7%)	6/43 (14%)	1/2 (50%)	3/4 (75%)	1/26 (3.8%)	6 Not improving/deterioration 2 Not coping at home 2 Allergy 1 Unable to void	
Endocarditis	34	34	5 (14.7%)	5/18 (27.8%)	0/1 (0%)	0/4 (0%)	0/11 (0%)	4 Deterioration 1 Heroin overdose	No difference between MMC and other sites (p=0.07)

MMC = Monash Medical Centre, DDH = Dandenong Hospital

* Excludes patients classified as “Indeterminate”

** Outcome not achieved = Unplanned cessation requiring inpatient admission, OR Outcome not achieved after unplanned interruption and return to HITH

Table 5

IV Antibiotic Program

Adverse reactions

	<u>Number</u>
Total treatment episodes	1686
No. episodes with adverse reaction	119 (%)
Adverse reactions:	
Allergy – anaphylaxis	3
Allergy – rash	28
Allergy – fever only	1
Diarrhea (alone or with other symptoms)	31
Nausea ± vomiting	43
Hepatotoxicity	3
Nephrotoxicity	2
Ototoxicity	2
Other (miscellaneous)	6

Table 7

**LMW Heparin Program
Outcome Summary**
n = 579

Diagnosis	Outcome achieved				Outcome not achieved		Indeterminate: unplanned cessation; special circumstances
	Achieved with no interruption	Achieved with no interruption (but symptoms at completion)	Achieved after planned interruption	Achieved after unplanned interruption then return to HITH	Unplanned cessation with transfer to an inpatient bed	Not achieved after unplanned interruption then return to HITH	
Total (n = 579)	526	1	23	10	17	2	-
Deep venous thrombosis (DVT) alone							
Lower limb DVT (n = 324)	308	1	2	5	7	1	-
Upper limb DVT (n = 17)	16	-	1	-	-	-	-
DVT (unspecified) (n = 25)	24	-	-	-	1	-	-
Neck DVT (n = 1)	1	-	-	-	-	-	-
DVT & Pulmonary embolism (n = 7)	7	-	-	-	-	-	-
Pulmonary embolism alone (n = 17)	16	-	-	-	1	-	-
CVA/Transient ischemic attack (n = 17)	17	-	-	-	-	-	-
Anticoagulation (unspecified) (n = 52)	41	-	7	4	-	-	-
Anticoagulation – post-op (n = 30)	27	-	-	-	3	-	-
Anticoagulation – pre-op (n = 40)	25	-	13	1	1	-	-
Anticoagulation – post-AMI (n = 16)	14	-	-	-	2	-	-
Anticoagulation – AF (n = 20)	19	-	-	-	1	-	-
Anticoagulation – post-EPS (n = 1) 1	-	-	-	-	-	-	-
Anticoagulation – angina (n = 5)	5	-	-	-	-	-	-
Anticoagulation – VT (n = 1)	1	-	-	-	-	-	-

Anticoagulation – pacemaker (n = 2)	1	-	-	1	-	-	1	-
Anticoagulation – post-partum (n = 2)	1	-	-	1	-	1	-	-
Anticoagulation – carotid stenosis (n = 1)	1	-	-	1	-	-	-	-
Anticoagulation – carotid dissection (n = 1)	1	-	-	1	-	-	-	-

Table 8**Post-Cardiac Surgery Program****Demographic data**

	Overall (Retrospective/Prospective)
No. episodes	359 (184/175)
No. patients	359
Age \pm SD (Range)	59.98 \pm 11.05 years (17 – 83)
Female	62
Male	297
Mean (\pm SD) length of HITH stay per episode (Range)	2.3 \pm 1.5 days (1 – 19 days)
Indications:	
Coronary bypass (CABG) alone	287
CABG + aortic valve replacement	4
CABG + mitral valve replacement	1
CABG post-acute myocardial infarct	27
Aortic valve replacement alone	19
Mitral valve replacement alone	13
Atrial septal defect repair	7
Patent ductus arteriosus repair	1

Table 9

Post-Cardiac Surgery Program

Outcome Summary

n = 359

Diagnosis	Outcome achieved				Outcome not achieved		Indeterminate: unplanned cessation; special circumstances
	Achieved with no interruption	Achieved with no interruption (but symptoms at completion)	Achieved after planned interruption	Achieved after unplanned interruption then return to HITH	Unplanned cessation with transfer to an inpatient bed	Not achieved after unplanned interruption then return to HITH	
Total (n = 359)	355	1	-	-	3	-	-
		<i>Reason:</i> 1x dyspnoea			<i>Reasons:</i> 1x wound breakdown 1x infected pressure area 1x dyspnoea		

Summary:

Achieved expected HITH outcome 356/359 (99.2%)
 Failed to achieve expected HITH outcome 3/359 (0.8%)

Table 10**Wound Management Program****Demographic data**

	Overall (Retrospective/Prospective)	MMC (Retro/Prospec)	Dandenong (Retro/Prospec)	Frankston (Retro/Prospec)	Geelong (Retro/Prospec)
No. episodes	90 (65/25)	6 (0/6)	0	14 (6/8)	70 (59/11)
No. patients	88				
Age \pm SD days* (n=90, Range)	52.9 \pm 18.2 (17 – 90)				
Female	48				
Male	42				
Mean (\pm SD) length of HITH stay per episode (Range)	10.2 \pm 10.9 days (2 – 83 days)				
Number of episodes per patient: 1 episode	86				
2 episodes	2				

* Age not calculated for all sites due to limited patient numbers

Table 11

Wound Management Program

Outcome Summary

n = 90

Diagnosis	Outcome achieved				Outcome not achieved		Indeterminate: unplanned cessation; special circumstances
	Achieved with no interruption	Achieved with no interruption (but symptoms at completion)	Achieved after planned interruption	Achieved after unplanned interruption then return to HITH	Unplanned cessation with transfer to an inpatient bed	Not achieved after unplanned interruption then return to HITH	
Total (n = 90)	82	-	-	2	5	-	1
					<i>Reasons:</i> 5x unsatisfactory progress		<i>Reasons:</i> Non-compliance

Summary:

Achieved expected HITH outcome	84/90	(93.3%)
Failed to achieve expected HITH outcome	5/90	(5.6%)
Indeterminate	1/90	(1.1%)