Investigating Health Technology Diffusion in New Zealand – How Does it Spread and Who Stands to Gain?

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Abstract

Previous Treasury research has identified “price and coverage” effects as playing a key role in the growth of historical health expenditure. This incorporates factors such as technological change and input prices including wages. Bryant et. al. (2004) found that between 1950-51 and 2001-02, growth in price and coverage effects was the main source of long run growth in government health expenditure and has accounted for 3-4% growth per year since the early 1990s.

This paper explores how a new health technology diffuses across District Health Boards (DHBs), the price and coverage effects, and whether access is evenly spread across the population i.e. who benefits from a new device or procedure.

In particular, it highlights:

- the variation in clinical practice between different DHBs
- the degree to which the adoption of a particular technology in one DHB impacts on neighbouring DHBs:
  - a “domino” effect occurs when the adoption of a technology in one DHB leads to other DHBs following suit
  - the adoption of a technology in one DHB leads to increased inter-district flows between DHBs.
- differences in access between geographical regions and also ethnic groups

The paper takes the example of a new procedure used in coronary care known as ‘stenting’ and examines its adoption across the different DHBs. Data used pertains to different heart procedures adopted across New Zealand over a particular time frame (1995-2004). It comprises patient details plus information relating to the DHB in which the procedure was carried out and also the patient’s domicile DHB.

JEL CLASSIFICATION I11
O33

KEYWORDS technology diffusion; coronary procedures; health expenditure

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1 Introduction and Motivation

International evidence (Australian Productivity Commission Report, 2005[1]) has identified advances in technology as a key driver of health spending. However, the overall impact of a particular innovation remains ambiguous. First, there is the issue of incentives facing each party in question and the regime under which decision makers operate. For instance high levels of regulation may act as a deterrent to the spread of new technology. Second, new technologies typically have both price and coverage effects whereby an advance in technology may reduce the cost of a particular outcome but broaden the scope of patients who can receive the treatment. Consequently, a number of factors influence the spread of technologies across a health sector.

This paper explores how a new health technology diffuses across District Health Boards (DHBs), the price and coverage effects, and whether access is evenly spread across the population i.e. who benefits from a new device or procedure. In doing so it also reveals a number of general issues in the health sector such as differences in policy settings and funding arrangements. These can contribute to:

- a variation in clinical practice between different DHBs;
- a differing degree to which the adoption of a particular technology in one DHB impacts on neighbouring DHBs:
  - a "domino" effect occurs when the adoption of a technology in one DHB leads to other DHBs following suit
  - the adoption of a technology in one DHB leads to increased inter-district flows between DHBs; and
- differences in access between geographical regions and also ethnic groups.

The paper takes the example of a new procedure used in coronary care known as 'stenting' (described later in the glossary of terms) and examines its adoption across the

[1] The report cites a number of other studies from Australia, US and UK which measure the impact of technology through a residual from using a regression based analysis. These include Wanless (2001) and Newhouse (1992).

different DHBs. Data used pertains to different heart procedures adopted across New Zealand over a particular time frame (1995-2004). It comprises patient details plus information relating to the DHB in which the procedure was carried out and also the patient's domicile DHB.

This investigation first sets out the literature describing technology diffusion as it relates to coronary care and hence what might be expected with regards to the New Zealand case. The data is then outlined in Section 3 with key results following in Sections 4 and 5. These are used to formulate policy issues in the concluding section.

2 Literature – What determines health technology diffusion?

An international body of work already exists that seeks to explain the diffusion of health technologies across countries i.e. why some adopt a procedure sooner than others (McLellan and Kessler, 1999). A number of incentives were identified which influence the process of technological change:

- **The degree to which costs are borne by patients** – Substantial out of pocket payments put a limit on technological growth.
- **Generosity of payments to hospitals** – Fixed global budgets are associated with a strong limit on technological growth whereas fee-for-service payments have the opposite effect.
- **Generosity of payments to physicians** – Where physicians are mainly salaried, technological growth is slow. When fee-for-service payments are offered there is a much greater incentive to adopt new technologies.
- **"Micro" technology regulation** – Countries that require extensive reviews of individual treatment decisions put a strong limit on technological growth. Those needing little or no case-level review area associated with fewer barriers to technological change.

2.1 The New Zealand Experience

2.1.1 Policy settings provide a starting point for understanding health technology in New Zealand…

How we configure our health services in New Zealand is determined in part by our geography. With a population equivalent to the size of a major overseas city yet relatively dispersed over a large geographical area, we face a particular set of circumstances.

New pharmaceuticals are reviewed by PHARMAC and hence barriers to diffusion exist here. However, the process for approving and adopting other technologies involving large new pieces of equipment or service reconfigurations is still in its infancy. In May 2005, the National Health Committee put together a report to the Minister of Health setting out recommendations for a health intervention process (Decision Making about New Health Interventions, 2005). The Ministry of Health and DHBNZ have subsequently put into place the Service Planning and New Health Intervention Assessment (SPNHIA). The new procedures call for a more collaborative decision making process between DHBs, the

Ministry of Health and other related bodies. Capital allocation is also considered and if the new technology requires it, then a separate set of guidelines exists for capital investment (Ministry of Health 2003 and 2005) once the technology has been approved by SPNHIA.

2.1.2 But the role of budgeting and funding arrangements must not be overlooked.

Related to the above section outlining current policy settings is the notion of budgeting and funding arrangements. The data used in this investigation spans a period which incorporates a number of different funding arrangements. Between 1991 and 1997 responsibility for purchasing health services shifted from local purchasing (with 14 area health boards) to regional purchasing (under 4 regional health authorities) to central purchasing with a single health funding authority. In 2001 District Health Boards came into existence each of which has a role in planning, funding, and providing health services for respective district populations. There are 21 in total and a large fraction of health funding is channelled through them.

This has implications for the adoption and dissemination of new technologies. Despite the lack of evidence on long term efficacy, the number of stents performed in New Zealand has increased dramatically since their introduction in 1995. In part, this may be explained by the manner with which they are funded e.g. if interventional cardiology services such as angioplasty and stents draw on different resources or silos from cardiac surgery (e.g. coronary artery bypass grafts, henceforth known as CABGs) then this may help to explain the rapid growth in one procedure.

Given that the 21 DHBs each have their own funding and provider roles, it is inevitable that there will be different views between DHBs on how best to fund similar services. Consequently, one would expect differences over time in how services are funded and purchased. However, this also has the potential to generate opportunities for some providers to leverage enhanced clinical capability particularly when the people using the new technology in their procedures are the same ones promoting it. Some commentators argue that this is the situation facing cardiology in New Zealand and that in this environment, clinicians and funders would appreciate information from technology assessment groups to advise on emerging technologies in the field.

2.1.3 Investing in new cardiac treatments carries a risk since it comes with high fixed or variable costs…

High Technology Treatments are those with high fixed costs or high variable costs per use. Many cardiac procedures fall into this category since they require substantial set up costs by hospitals in hiring specialised personnel (e.g. interventional cardiologists) and purchasing specialised equipment (e.g. catheterisation tables and fluoroscopes). Notably, it has been found that countries using fixed provider payments had relatively little growth in the use of these invasive procedures. (McClellan and Noguchi, 1998).

2.1.4 …but successful new innovations in cardiology are highly regarded by international clinicians.

In a recent survey, 225 leading general internists in the US were asked to rank the relative importance to patients of thirty medical innovations (Fuchs and Sox, 2001). The results put Balloon Angioplasty with Stents in 3rd place with Coronary Artery Bypass Grafts

coming in 5th. This is not surprising given the high incidence of cardiovascular disease in the US and hence a significant "ability to benefit" in the population. Given that New Zealand faces similar pressures we might expect our rankings to be much the same as those in the US.

2.1.5 So with limited information on the spread of new technologies across New Zealand, there is a need to look further afield.

Despite the growing interest in technology diffusion, very little information exists that examines the spread of technology across regions *within* a country and no work to date has looked at health technology diffusion between the different DHBs of New Zealand. There is, however, considerable anecdotal evidence that can be tested against the data and a preliminary analysis provided by James Harris (2005) from a seminar entitled "Changing Priorities: Stents in Cardiovascular Care".

While Harris's work did not focus explicitly on the spread of a technology across New Zealand's DHBs, it did reveal some problems encountered when a new technology is first introduced into an area, drawing comparisons with the Australian case.

His paper revealed that the process for adopting new technologies has differed between Australia and New Zealand. Australia did not fund the newer forms of stent devices until they were approved by the national Medical Services Advisory Committee (MSAC). The first drug eluting stents (DES) were added to the Australian Register of Therapeutic Goods (ARTG) as a non-current entry in 2000-01. This was conditional on the drug that coated the stent being approved for treating coronary heart disease. The approval was granted by the Therapeutics Goods Administration in June 2002. In 2005, MSAC carried out an assessment of DES for the Health Policy Advisory Committee. It was determined that the procedure was safe and more cost effective than bare metal stents mainly because it reduces rates of revascularisation at up to one year post procedure. However, it stressed that additional clinical practice data was needed since it was still early days with regard to the use of this device. In the same year, the Australian Productivity Commission Report outlined possible long term problems associated with these stents such as inflammatory responses and thrombotic reactions.

By contrast, New Zealand has not carried out national assessments, and has arguably weaker national controls over the details of hospital spending than Australia. Most health purchase choices are made locally at the DHB level with DHB funding and planning arms controlling provider arm spending within a budget set by ministers given district annual plans and district strategic plans. Until recently, New Zealand has effectively delegated decisions on devices and procedures to clinicians. After being introduced in New Zealand in 1995, stenting quickly became a popular procedure. However, when the newer drug eluting stents were introduced in 2002/03 their use became confined to particular hospitals and DHBs because of their cost and the lack of established clinical data supporting their use in New Zealand. This is relevant when we consider the following cost information.

Table 1 – A Comparison of Individual Costs and Total Expenditure on Different Interventions

	Unit Cost	Total Cost - 2002 (millions of dollars)
CABG	$21 400	42.7
PTCA	$6 300	2
Stent	$6 900	20.4

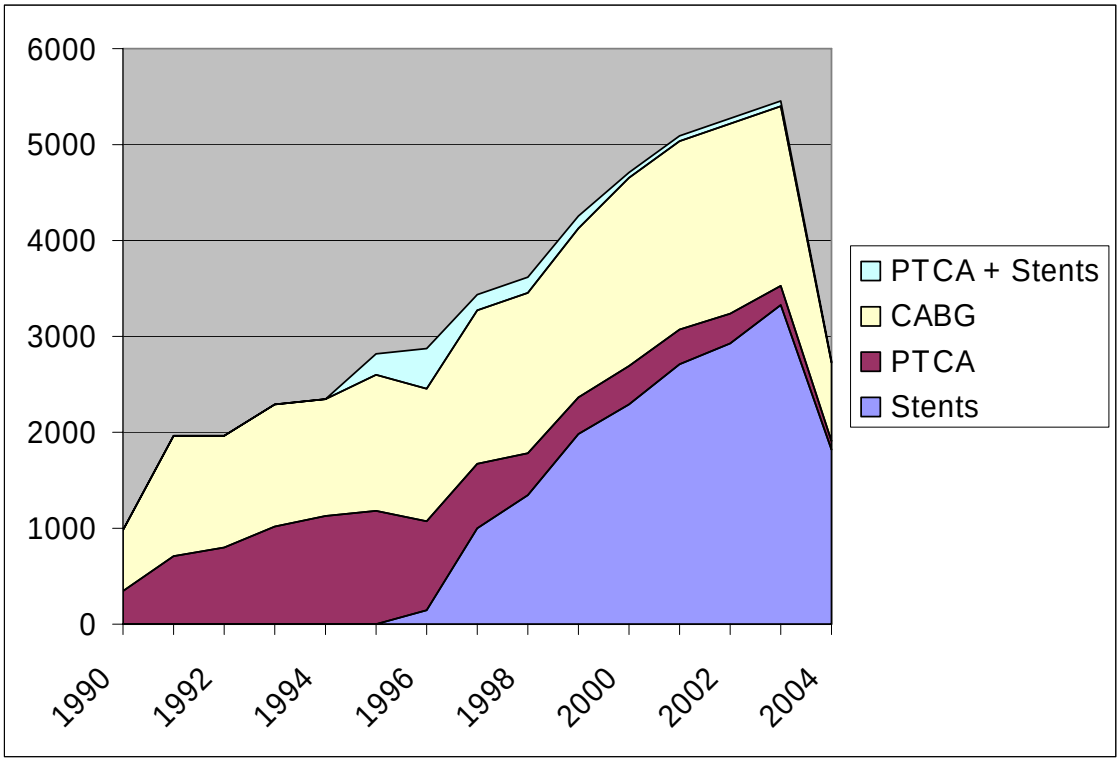
Source: Harris (2005). Note that PTCA refers to percutaneous transluminal coronary angioplasty.

2.1.6 The use of bare metal stents has not been a substitute for the more expensive existing technologies…

If PTCAs and Stents were perfect substitutes for CABGs we would expect the number of CABGs to decrease while the number of stents and PTCAs would increase by the same proportion. Equally, expenditure on coronary care would be considerably reduced from the improvement in technology. This has not been supported by the data. Indeed, examination of more recent data finds that CABGs have been on the increase. This is seen in Figure 1 showing the number of admissions to New Zealand hospitals for the period 1990-2004 for each procedure.

The fact that we do not see this substitution effect suggests that the existence of stents has increased the number of candidates receiving an intervention. An obvious inference is that patients with low clinical complexity who in the past may not have had an intervention of any kind are now prime candidates for a stent hence the increase in numbers. Moreover, these procedures are performed by an interventional cardiologist and are stimulating and rewarding to do. There is then an incentive for more to be done to seek suitable candidates thus increasing the pool of patients treated for coronary artery disease.

Figure 1 – Number of Stents, Angioplasty and CABG Admissions



Source: NZHIS (2005)

Note: The data is expressed here in terms of calendar years but represents data from mid 1990 to the end of the 2003-04 financial year. The observed decline in 2004 is because we have only included six months of data for that year.

2.1.7 …because the procedures are not interchangeable

Wellington cardiologists stressed that clinicians cannot substitute CABG with angioplasty since there are many instances where CABG is the more appropriate (and safer) option. This depends on:

- the number of vessels which are involved;
- the distance over which the artery has narrowed;
- whether the patient has experienced a heart attack in the past; and
- the size of the blockage.

Therefore continued use of CABG is not necessarily a sign of a lack of technology diffusion but may also reflect the conditions presented by patients. Hence any analysis of new technology uses must also take into account the change in clinical complexity of each case.

Notably, when the health literature debated the relative efficacy of CABGs and stents (Hannan et al. 2005, Hill et. al. 2004, Weinstein 2003, to name just a few), the general view was that stenting was suitable for patients with low clinical complexity or limited disease. A number of studies have pointed to the fact that it is wrong to look at stenting as a "one off" procedure and then compare costs with a CABG since people could have

multiple stents before finally coming up for a CABG. It may therefore be better to think of stenting as a strategy rather than a single procedure.

Furthermore, technology has advanced not just in the nature of the devices (e.g. drug eluting stents versus bare metal stents) but also in surgical advances which allow stents to be used in places not previously reachable. Moreover, new technologies enable clinicians to treat people who could not be treated with the older technologies. Consequently, while the cost of a heart operation may fall with advances in technology, the number of people treated increases dramatically thus driving up overall expenditure in the cardiology area.

2.1.8 The evidence on drug eluting stents is inconclusive because the device has only recently been introduced so advisory committees are acting with caution…

Drug eluting stents (DES) have only been used in New Zealand for the past 3 years and are subject to considerable controversy. The actual DES costs on average $5800 while bare metal stents are considerably cheaper at $950. Hence in the absence of international evidence showing outcome advantages for the DES, the bare metal stent would appear more cost effective. However, anecdotal evidence suggests DES have been adopted around New Zealand on the basis of individual judgement so that now, some cardiologists adopt the DES while others stick with the bare metal stent. Evidence from one DHB suggests that there are discrepancies with the use of drug eluting and bare metal stents between neighbouring DHBs. The benefits of using the more expensive drug eluting stents are not conclusive (despite the MSAC findings). Hence some DHBs are opting for bare metal stents in their surgery. However, other DHBs have already adopted the use of drug eluting stents, perhaps because they do not face such tight funding constraints.

The controversy concerns the manner with which this dissemination took place. The DES was not required to pass a clinical trial in New Zealand before being taken into practice. Given its cost and concern over the drug coating of the DES (i.e. possible long term problems outlined in the Australian Productivity Commission Report, 2005), this questions the process through which new technologies are introduced into New Zealand hospitals.

In terms of the data presented here, the International Classification of Diseases (ICD9) makes no distinction between drug eluting and bare metal stents so we cannot see the extent to which one type is used instead of another hence our comments are based on anecdotal evidence from practitioners in different DHBs.

2.1.9 …but there are a number of factors influencing its adoption.

Influence of the patient – Anecdotal evidence suggests that as patients become more well-informed through media or internet, they tend to pressure clinicians for particular procedures. This makes it even more difficult to reverse the trend of a relatively “poor” technology (e.g. less cost effective than alternative choices) in the absence of robust research which may not become available in the short term.

Staffing – Interventional cardiologists and specialised nurses are typically attracted to those DHBs with a specialised research-oriented hospital (such as Capital and Coast District Health Board, Waikato District Health Board and Canterbury District Health

Board). Conversely, it is very difficult to attract skilled staff in isolated hospitals outside these DHBs, which may generate inequalities. However, this is not necessarily a bad thing if: (a) a particular safety threshold exists for the number of procedures performed by a cardiologist in a certain time frame; or (b) it is costly to perform only a few such procedures in an institution. Sadly, the data does not decompose to individual clinicians. Nevertheless, it does show each facility (e.g. hospital) in which the procedure is carried out. This means that we can get an idea of the volume of patients treated in a hospital over a particular time period.

Domino effects and Inter-district flows

With regard to technological diffusion, problems exist between neighbouring DHBs. For instance it has been suggested that if Capital and Coast decided to take up the procedure of offering drug eluting stents, Hutt Valley would feel the impact through increased inter-district flows. Work has started in New Zealand to make comparisons across DHBs (Sharpe and Wilkins, 2004) in order to ensure quality and equity in cardiovascular health across the country. Initial results suggest that inequalities do indeed exist particularly when comparing between those hospitals regarded as "intervention" centres and those that are not. The examples used in their study were Waikato and Taranaki hospitals. Significantly higher revascularisation rates were seen at Waikato where management was performed by cardiologists with immediate access to invasive intervention facilities. It is a subject for debate as to whether decision making should take this form (Conaglen et al. 2004). As may be expected, some DHBs cannot afford to take on new technologies. Consequently, technological diffusion may be strongly influenced by the degree to which the DHB is funding constrained.

3 Data

The study uses data taken from New Zealand Health Information Service (NZHIS) that includes any patients who underwent one of the procedures outlined in Table 2. Notably this does not consider patients using the private sector. As such, the figures do not tell a complete story about national intervention rates but only what is happening in the public sector. The codes follow the International Classification of Diseases (ICD9) and are consistent with other recent investigations into cardiac services in New Zealand (Doolan-Noble, Broad, Riddell and North, 2004). Notably it runs from mid 1990 to mid-way through 2004 (which represents the end of the financial year, 2003/04), hence calendar years 1990 and 2004 do not constitute a full year of data.

Table 2 – Procedure Codes Used in Data Analysis

Code	Procedure
3601	Single vessel PTCA without mention of thrombolytic agent
3602	Single vessel PTCA with thrombolytic agent
3603	Open chest coronary artery angioplasty
3604	Intracoronary artery thrombolytic infusion
3605	Multiple vessel PTCA performed during single operative episode
3606	Dilation/stenting of single coronary vessel
3607	Dilation/stenting of multiple coronary vessels
3609	Other removal of coronary artery obstruction
3610	Aortocoronary bypass for heart revascularization, NOS
3611	Aortocoronary bypass of one coronary artery
3612	Aortocoronary bypass of two coronary arteries
3613	Aortocoronary bypass of three coronary arteries
3614	Aortocoronary bypass of four or more coronary arteries
3615	Single internal mammary-coronary artery bypass
3616	Double internal mammary-coronary artery bypass
3619	Other bypass anastomosis for heart revascularisation

4 The Big Picture – Results from the Entire Sample (Stents, Angioplasty and CABG)

4.1.1 After their introduction in 1995, the use of stents increased rapidly but the number of admissions for a CABG also continued to rise.

The data in Table 3 is reproduced in Figure 1 of Section 2. Notably, there is a sharp increase in the use of stents after their introduction in 1995 but a steady increase in the number of admissions for a CABG. This is consistent with the hypothesis that bypasses are now being performed on patients who may not have received that treatment a decade ago. Advances in other areas of technology such as anaesthetics have enabled other groups to safely undergo this procedure.

Table 3 – No. of Admissions for Stents, Angioplasty and Bypass Grafts

Year	Stents	PTCA + Stents	PTCA	CABG
1990			339	643
1991			702	1257
1992			797	1162
1993			1022	1274
1994			1131	1206
1995	9	217	1179	1414
1996	154	427	917	1378
1997	999	152	674	1606
1998	1348	158	426	1680
1999	1989	130	371	1760
2000	2296	64	393	1962
2001	2717	65	347	1964
2002	2933	59	308	1971
2003	3325	58	203	1865
2004	1817	25	91	820

4.1.2 The average age of patients increased across the period and their length of stay in hospital reduced…

Table 4 – Average Age of All Admissions for Cardiac Procedures between 1990 and 2004

	Average Age	Length of Stay
1990	59.89	11.78
1991	60.19	11.08
1992	60.39	10.43
1993	60.88	9.89
1994	60.88	9.47
1995	61.21	8.85
1996	61.49	8.72
1997	62.47	8.23
1998	62.35	8.16
1999	62.51	7.53
2000	62.66	7.42
2001	63.12	6.80
2002	63.13	6.70
2003	63.25	6.61
2004	63.02	6.59

Table 4 is supportive of the hypothesis that more risky patients are being treated. The table shows very broadly the average age of patients undergoing any of the procedures across the period. In a period of 14 years this average has risen by just under 4 years. Alongside this, the average length of stay in hospitals has dropped from 11.8 days in 1990 to 6.6 days in 2004.

4.1.3 …but the benefits of the technology are not equally distributed across all sections of the community.

At first glance the evidence appears favourable. It seems that New Zealanders have experienced an increase in access to these procedures. The number of operations has gone up together with the average age of people being treated. However, we need to ascertain whether these technological advances are being equally spread across the entire community by looking at the age, ethnicity and domicile of the people undergoing the operations. We also need to see whether this increase in output is achieved across all facilities.

Table 5 – Ethnic Group of Each Patient

Ethnic Group	Number of Admissions	% of Total
NZ European	38911	78.02
Other European	3399	6.82
NZ Maori	2229	4.47
Other	1751	3.51
Indian	907	1.82
European Not Further Defined	524	1.05
Not stated	521	1.04
Samoan	377	0.76
Chinese	262	0.53
Fijian	194	0.39
Other Asian	155	0.31
Cook Island Maori	142	0.28
Tongan	126	0.25
Niuean	96	0.19
Middle Eastern	85	0.17
Other Pacific Island	63	0.13
South East Asian	35	0.07
African	31	0.06
Asian not further defined	27	0.05
Tokelauan	18	0.04
Pacific Island Not further defined	15	0.03
Latin American/Hispanic	5	0.01
Total	*49873*	

Clearly the largest group to undergo the cardiac procedures listed are NZ Europeans at 78% of the sample with NZ Maori accounting for just 4%. Given that Maori males have an age standardised heart disease mortality rate 65.5% higher than non-Maori, one would have expected this figure to be greater if access were the same for all (See Table 6). According to Statistics New Zealand, the Maori population account for 14.1% of the population and Pacific Island people make up 6.2%. The fact that they are under represented here raises issues of accessibility and equity. The Ministry of Health has long stressed the importance of tackling cardiovascular disease particularly with regard to Maori and Pacific Island people and has devised ongoing programs to improve knowledge in the area (New Zealand Health Strategy, DHB Toolkit, Cardiovascular Disease – To reduce the incidence of cardiovascular disease, 2003). With many of these policies geared towards the long term, one would not expect instant reductions in the mortality

rate. But the observed difference in access suggests that it would be useful to monitor future numbers in each major ethnic group receiving coronary procedures.

Table 6 – Numbers and Rates of Death from Ischaemic Heart Disease by Sex and Ethnicity, 1999-2001

		1999		2000		2001	
		No.	Rate	No.	Rate	No.	Rate
Maori	Male	347	233.7	308	201.4	285	176.7
	Female	207	129.1	195	113.8	209	119.0
Non-Maori	Male	3299	121.9	2961	106.8	3104	106.8
	Female	2718	56.9	2509	51.5	2773	54.3
Total	Male	3646	130.7	3269	114.1	3389	112.8
	Female	2925	61.9	2704	55.7	2982	59.0

Source: Mortality and Demographic Data 2001, New Zealand Health Information Service, Table 17, Page 22.Note: The rates are per 100000, age standardised to Segi's world population

Of further interest is the gender balance. Males accounted for 73% of admissions while females accounted for 27%. However, this is consistent with the mortality data produced by the NZHIS (Table 6). Age standardised death rates for ischaemic heart disease were 112.8 per 100 000 for men and 59 per 100 000 for women.

4.1.4 And the age-standardised mortality rate has not decreased for all groups in society.

Table 6 also illustrates the age-standardised mortality rate over time. Notably it only incorporates data for the years 1999 to 2001 and hence there are only 3 data points for each series. Nevertheless it shows that mortality rates do not drop for ischaemic heart disease for all groups within the sample. Clearly mortality rates are related to a number of factors of which technology is only one.

4.1.5 Inter-district flows become an issue when new technology is not widely disseminated

It is important to establish where people live in relation to the place where they receive treatment. Appendix Table 1 (attached) shows the domicile DHB for each of the 49873 admissions in the sample alongside the agency providing the service. This provides information regarding inter-district flows and stresses the importance of correctly pricing hospital procedures.

Appendix Table 1 shows that there are 5 main DHB centres for the cardiac procedures; Auckland; Waikato; Capital and Coast; Otago; and Canterbury. Naturally, patients domicile to these DHBs generally have their operations performed there. What is of interest, are those patients living outside the main centres. For example, Hutt Valley, Mid Central and Hawkes Bay people are predominantly treated by neighbouring Capital and Coast; Tairawhiti patients are treated by Waikato DHB; and Southland patients are treated by Otago DHB. The numbers suggest a substantial inter-district flow towards the main centres.

5 Disaggregating the Data – Results from Individual Procedures, DHBs and Hospitals

Disaggregating the data allows us to look at the individual procedures across different DHBs and hospitals. This is particularly useful for examining the extent to which populations in each region have access to both new and well established technologies.

5.1.1 Maori and Pacific Island people are not well represented in the sample but the ethnicity mix is changing over time for certain regions.

The aggregate data suggest that ethnic groups other than NZ European are underrepresented. However, the disaggregated data provide a richer story. Table 7 decomposes stent procedures (i.e. a new technology) for each DHB based on patient age, gender, and ethnicity. Figures for Auckland, Canterbury and Waikato show a reduction in the proportion of patients who are NZ European with figures for the remaining DHBs showing no significant change.

Table 7 – Decomposing Stent Procedures by Patient Type

DHB		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Auckland	Age	58.8	61.2	60.6	59.9	59.8	60.4	61.5	62.2	61.2	61.7
	Gender	75	68	75.6	68.6	73.6	71.2	72.5	68.3	73.8	73.8
	Ethnicity	82.4	85.7	84.9	80.4	74.4	68.4	68	65.4	59.3	56.3
C & C	Age	56.7	58.6	60.1	61.9	61.4	62.1	61.6	61.5	61.9	61.3
	Gender	100	67.2	72.2	73.1	66.2	68.6	70.7	67.3	73.4	73.1
	Ethnicity	100	65.7	66	70.8	66.2	74.7	73.5	73.8	72.6	69.1
Otago	Age	63.2	58.4	61.1	61.2	61.3	61.8	62.8	63.1	64.6	63.8
	Gender	69.1	78.9	71.5	71.4	69.6	68.8	69.6	68.1	68.9	72.8
	Ethnicity	81.8	85.6	80.1	87.4	87.5	83.4	84.6	83.6	82.1	83.2
Waikato	Age	58.2	57.8	59.3	60.2	62.3	61.7	62	60.7	61.7	62.2
	Gender	77.8	74.4	76	68.7	64.4	68.9	69.9	73.8	70	70.9
	Ethnicity	77.8	83.7	86	79.1	79.7	76.7	74.2	75.2	77.8	76.2
Canterb.	Age	75	58	54.2	60.4	62.6	63	62.6	62.1	63.4	63.1
	Gender	100	100	83.3	69.9	70	66.5	67.7	71	71.2	68.5
	Ethnicity	0	100	83.3	82.1	80.5	76.5	74	70.1	70.5	69.4
Manukau	Age			57	59.3	55.4	56.9	58.3	57.5	60.3	67
	Gender			100	55.6	52.6	70	85.7	75	100	83.3
	Ethnicity			0	55.6	42.1	60	64.3	75	50	66.7
Mid Cen.	Age				63					79	
	Gender				100					100	
	Ethnicity				0					100	
Hutt	Age					67.5	46.5	54			50
	Gender					100	100	63.6			100
	Ethnicity					100	50	72.7			100
Nelson	Age								70		
	Gender								0		
	Ethnicity								100		

Note: Gender refers to the percentage of males in the sample receiving a stent Ethnicity refers to the percentage of stent recipients who describe themselves as NZ European.

5.1.2 Access to the new technology varies according to ethnicity and where you live…

Appendix Tables 2 and 3 (attached) standardise the number of stent procedures for patients per 1000 of the population based on their domicile DHB. Appendix Table 2 shows the cumulative figure of stent procedures for the period 1995-2004 whereas the Appendix Table 3 provides the last complete year of data (2003). This raises several important points. First, when looking at the cumulative figures for stents, the standardised number of stents for Maori and Pacific Island people consistently falls short of that of NZ Europeans. Furthermore, this disparity is at its greatest for people living in DHBs in the South Island. However, when 2003 data is taken in isolation, these disparities narrow. One would not want to put a large weight on this particular point given that the analysis is based on small numbers and is not standardised for age. For instance, the total population of DHBs on the South Island is 906 744 with Maori and Pacific Island people constituting just 79 533 i.e. 8.77% of the population. A much higher proportion of the Maori and Pacific Island populations is younger than 20, than of the NZ European population so one would expect a lower rate of cardiac procedures compared with NZ Europeans. Nevertheless, it is worth flagging at this stage.

5.1.3 Access to a well established technology also varies according to ethnicity and domicile DHB.

Appendix Tables 4 and 5 (attached) standardise the number of CABGs for patients per 1000 of the population based on their domicile DHB. Appendix Table 4 shows the cumulative figure of CABGs for the period 1995-2004 with Appendix Table 5 showing the last complete year of data (2003). As with stents, disparities exist between ethnic groups. However, these are equally large across the entire country. When looking at the 2003 data alone, there are domicile DHBs in which the standardised number of CABGs is the same or greater for the Maori and Pacific Island community than for the NZ Europeans (Northland, Auckland, Capital and Coast, South Canterbury and Southland). Again, this is based on small numbers and data that has not been age standardised but is worth noting and monitoring for future years since this may suggest that balance is being redressed.

5.1.4 The new technology is most likely to be found in hospitals where patient volume is high and where there are teaching and research links…

In tracing the spread of the new technology, Table 8 shows the district health boards in which stents have been performed and the number of admissions. Clearly this is dominated by the “Big 5” but there are other smaller DHBs which have also at some stage offered the procedure.

Table 8 – The Number of Admissions for Stent Procedure

District Health Board	No. of Admissions
Auckland	6114
Capital and Coast	3864
Canterbury	3637
Otago	2698
Waikato	2538
Manukau	71
Hutt Valley	17
Mid Central	2
Nelson and Marlborough	1
Total	*18942*

Table 9 breaks the admission numbers down by year and hence shows the dispersal of the technology. This shows that the pioneers were Auckland, Capital and Coast, Otago and Waikato in 1995 with Christchurch following suit in 1998. Closer examination shows the hospitals that were responsible.

Appendix Table 6 provides an interesting story. Clearly, a number of Auckland hospitals have used the technology (National Womens, Greenlane, Auckland and Auckland City). However, Auckland City Hospital opened in 2003 and brought together the services of Auckland, Greenlane and National Womens Hospitals into one building. The general trend in the DHB has been a steady increase in this procedure. The other main facilities have been Wellington, Waikato, Dunedin and Christchurch Hospitals and these have also seen an increase in stenting.

Table 9 – No. of Stents Performed in each District Health Board

DHB	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Auckland	153	259	509	541	614	711	785	899	1078	565
Capital and Coast	7	67	194	342	355	430	649	679	737	404
Canterbury	1	5	12	156	549	590	612	649	704	359
Otago	55	208	326	294	319	320	312	317	363	184
Waikato	9	43	109	163	261	296	399	439	496	323
Counties Manukau	0	0	1	9	19	10	14	8	4	6
Hutt Valley	0	0	0	0	2	3	11	0	0	1
Mid Central	0	0	0	1	0	0	0	0	1	0
Nelson and Marlborough	0	0	0	0	0	0	0	1	0	0
Total	*225*	*582*	*1151*	*1506*	*2119*	*2360*	*2782*	*2992*	*3383*	*1842*

5.1.5 Stenting has been associated with falling cost weights while cost weights have risen for CABGs…

Table 10 provides the cost weight figures for stents and CABGs for 2000-2004 (the data is not available for the period pre-2000). Cost weights are smaller for stents than CABGs, with a small reduction in the stent cost weights over the period to 2004. Conversely, CABGs are associated with rising cost weights. However, once changes in clinical

complexity are noted for both CABGs and stents, it is apparent that the scope of patients receiving coronary operations has broadened as procedures become commonplace.

Table 10 – Aggregate Clinical Complexity and Cost Weight Figures

	Cost Weights and Clinical Complications for Stents and CABGs			
	Stents		CABGs	
	CW	*CCL*	*CW*	*CCL*
2000	3.296	1.664	7.521	2.394
2001	2.877	1.673	7.889	2.447
2002	2.664	1.694	8.362	2.429
2003	2.67	1.7	8.686	2.55
2004	2.764	1.747	8.854	2.618

5.1.6 …but clinical complexity and average age of patients has increased.

Table 11 provides a comparison of clinical complexity and cost weight figures for patients receiving stents in each of the DHBs. Clinical complexity has significantly increased for the South Island DHBs but remained steady for those in the North. This confirms the notion that coverage can be a factor driving health expenditures associated with technology. Comparisons may also be drawn with the well established technology, CABGs. Appendix Table 7 shows the use of CABGs across different DHBs. Notably, neither clinical complexity nor the average age of patients has remained constant over the period. With the exception of Canterbury, where there are no signs of an increase in clinical complexity of patients receiving CABGs, each has risen over the period. This supports the view that scope has increased not just as a consequence of the introduction of stents, but also in a general advancement in technology e.g. improved anaesthetics.

Table 11 – Clinical Complexity, Cost Weight Figures and Intervention Rates for Stents in Different District Health Boards

DHB	2000			2001			2002			2003			2004*		
	CW	CCL	IR	CW	CCL	IR	CW	CCL	IR	CW	CCL	IR	CW	CCL	IR
Auckland	3.14	1.78	0.19	2.87	1.8	0.21	2.67	1.84	0.24	2.77	1.77	0.29	2.71	1.78	0.31
Counties Manukau	3.09	1.2	0.00	2.95	1.29	0.00	3.12	2.13	0.00	2.55	1	0.00	2.69	2	0.00
Waikato	3.29	1.73	0.09	3.08	1.62	0.13	2.77	1.7	0.14	2.8	1.56	0.16	2.75	1.65	0.2
Mid Central										2.24	1	0.00			
Hutt	3.07	1.33	0.00	2.88	1.09	0.00							2.92	1	0.00
Capital and Coast	3	1.5	0.17	2.57	1.36	0.26	2.46	1.35	0.28	2.53	1.4	0.3	2.74	1.54	0.33
Nelson-Marlborough							2.24	3	0.00						
Canterbury	3.64	1.6	0.14	3.13	1.81	0.14	2.82	1.76	0.15	2.77	1.97	0.16	2.88	1.96	0.17
Otago	3.43	1.7	0.19	2.77	1.86	0.18	2.61	1.86	0.19	2.55	1.77	0.21	2.68	1.85	0.22

* denotes half a calendar year of data. The intervention rate has been altered to take account of the smaller sample of data. Intervention rates refer to the number of people in the DHB receiving a stent as a percentage of the total population in the DHB.

6 Concluding Comments – Policy Issues

There are a number of issues arising from the findings of this analysis:

First, are the issues of cost- and clinical effectiveness. While the stent itself is cheaper than performing a CABG, the evidence has shown that it is associated with an increase in coverage thus generating an increase in health expenditure. However, this study does not take into account the associated benefits of a healthier workforce, reduced morbidity and mortality rates which clearly need to come into the equation when deciding whether to adopt a particular technology.

Second, there is the question of who benefits from the technologies and whether these benefits are accessible to all (and indeed whether they need to be!). In the case of coronary care, the evidence suggests that groups other than NZ European are underrepresented in the data so this calls into question (a) whether technology is disseminating appropriately or (b) whether the access problems exist at the primary care level hence a smaller number of referrals for coronary procedures.

6.1.1 There is a trade off between regulating the spread of a new technology and providing incentives for innovation

As outlined in the literature survey, we face a difficult trade off. If technological advances are constrained by too many layers of bureaucracy, this is likely to act as a deterrent to a number of valuable advances. Until recently, the set up in New Zealand allowed for new technologies to spread with little or no regulation (e.g. drug eluting stents). As such, more costly procedures could disseminate the market with only limited evidence supporting their use.

In May 2005, the National Health Committee put together a report to the Minister of Health setting out recommendations for a health intervention process (Decision Making about New Health Interventions, 2005). The Ministry of Health and DHBNZ have subsequently put into place the Service Planning and New Health Intervention Assessment (SPNHIA). The new procedures call for a more collaborative decision making process between DHBs, the Ministry of Health and other related bodies.

The process has already been trialled in the provision of brachytherapy (a procedure in which radioactive material is placed directly into or near the cancer. The radiation is sealed in needles, seeds, wires, or catheters.) To date, the process has been deemed a success with brachytherapy now reaching the third phase of the process. However, there are critics who note that there are too many layers of bureaucracy and hence the process is longer than it need be.

One may also argue that a technology may be introduced into medicine, highly regarded and disseminated widely yet clinical and cost evidence can only follow with a considerable lag. It is too early to say whether stents demonstrate long term efficacy or differ significantly from a clinical or overall cost basis from other coronary procedures.

Meanwhile, James Harris has suggested that we meld some of the positive features of the UK's National Institute for Clinical Excellence (NICE) and PHARMAC. In particular he points to NICE's breadth of scope and PHARMAC's ability to negotiate over price, its

evaluation and budgetary processes. Together this could improve New Zealand's resource allocations through a national technology assessment process.

While an institution like PHARMAC is not always popular with clinicians, it has proven success for dealing with drug companies and constraining costs. In its recent publication (Annual Review 2004) it compares pharmaceutical costs with what would have emerged in the absence of regulation. The volume of drugs prescribed has climbed steadily with costs remaining stable in recent years. It will be interesting to see if the new SPNHIA process is able to deliver this type of service.

6.1.2 Final Comments

Empirical evidence suggests that technology changes account for a significant proportion of health expenditure. While key studies for New Zealand are scarce, early findings suggest that it is likely that new interventions play just as significant a role in health spending as for other countries (Bryant et al., 2004). However, at present New Zealand's framework for assessing new interventions is still in its infancy. As such this paper provides the first steps in analysing the way in which new technologies reach patients.

Clearly, there are still a number of issues to be addressed and much work to be performed in the area. However, it is hoped that by examining technology advances in the cardiac area we will shed light on how the current system works and how processes can be made more efficient in the future.

Glossary of Terms

Coronary Angioplasty – 'Angio' means artery and 'plasty' means opening. This is the procedure used to widen the narrowing in a coronary artery with a special balloon. The narrowing is caused by a build up of fatty deposits in the walls of the arteries. A catheter with a deflated balloon attached to the tip, is passed into the coronary artery under x-ray guidance. A coronary angiogram is performed and the balloon is positioned within the narrowed artery. The balloon is then inflated widening the artery and improving blood flow. Occasionally an angioplasty is performed as an emergency procedure to try to improve blood flow during a heart attack.

Coronary Artery Bypass Graft (CABG) – This is an operation to bypass a narrowed or blocked segment of a coronary artery using a graft. CABG surgery is performed primarily to relieve angina symptoms.

Percutaneous Transluminal Coronary Angioplasty (PTCA) – Angioplasty (with or without a stent) is also known as PTCA or Percutaneous Coronary Intervention.

Revascularisation – This describes the procedure for either opening up existing blood vessels (through angioplasty) or bypassing the blockage of the coronary arteries (through a coronary artery bypass graft).

Stents – A stent can also be inserted at the time of the angioplasty. It is a metal mesh or coil tube that can be inserted into the narrowed artery. It acts as a scaffold by widening the artery and keeping it open. Stents are argued to be superior in the long term compared with angioplasty.

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Appendix

Appendix Table 1 – The Domicile DHB and Agency of Each Separate Admission

Domicile DHB / Agency	Northland	Waitemata	Auckland	Manukau	Waikato	Lakes	Bay of Plenty	Tairawhiti	Hawkes Bay	Taranaki	Mid Central	Whanganui	Capital and Coast	Hutt	Wairarapa	Nelson	West Coast	Canterbury	S. Canterbury	Otago	Southland	Overseas
Northland	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waitemata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auckland	1615	5092	4536	4025	128	52	173	17	1035	200	34	4	15	9	4	18	5	159	2	8	3	168
Counties Manukau	0	1	5	102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Waikato	11	15	10	27	4256	1009	2018	345	27	784	10	13	4	5	1	2	1	11	13	4	7	28
Lakes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bay of Plenty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tairawhiti	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hawkes Bay	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	1	0	0	0
Taranaki	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Mid Central	0	0	0	0	0	0	0	0	1	1	14	0	0	0	0	0	0	0	0	0	0	0
Whanganui	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Capital and Coast	8	3	6	2	5	5	10	4	915	95	1139	621	2628	1405	411	1333	32	14	1	3	1	163
Hutt	0	0	0	0	0	0	0	0	0	0	0	0	1	41	0	0	0	1	0	0	0	0
Wairarapa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nelson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	2	0	0	0	0	1
West Coast	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Canterbury	1	1	4	1	4	3	3	0	4	1	5	1	3	3	0	29	281	5035	332	19	8	57
Canterbury (HLS)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	26	0	0	0	0
S. Canterbury	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Otago	1	4	2	0	15	2	13	1	5	4	1	0	1	2	1	40	201	2441	422	3718	1349	246
Southland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Heart Surgery South Island	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	20	37	353	160	1
Mercy Auckland	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	1	0	0	0
St Georges	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Wakefield Hospital	0	0	0	0	0	0	0	0	3	0	14	1	15	8	2	4	0	0	0	0	0	0
Not specified	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Western Bay Health	0	0	0	0	0	1	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
East Bay Health	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix Table 2 –Cumulative Figures for Stent Operations between 1995 and 2004

District Health Board of Domicile	No of Stents 1995-2004	Total Pop'n in DHB	No of Stents Per 1000 of Total Pop'n	Total Non-NZ Europ'n in DHB	Total NZ Europ'n in DHB	Total Maori & Pacific Island in DHB	No of Stents NZ Europ'n	No of Stents Non-NZ Europ'n	No of Stents Per 1000 of Non-NZ Europ'n	No of Stents Per 1000 of NZ Europ'n	No of Stents Maori & Pacific Island	No of Stents Per 1000 of Maori & Pacific
Northland	600	140127	4.3	46299	93828	43890	455	145	3.1	4.8	78	1.8
Waitemata	1899	429756	4.4	131529	298227	72624	1391	508	3.9	4.7	99	1.4
Auckland	1760	367734	4.8	160797	206937	80370	1151	609	3.8	5.6	159	2.0
C. Manukau	1509	375531	4.0	185250	190281	143814	969	540	2.9	5.1	232	1.6
Waikato	1334	317751	4.2	127470	190281	74454	1046	288	2.3	5.5	100	1.3
Bay of Plenty	573	178161	3.2	47487	130674	45912	419	154	3.2	3.2	49	1.1
Lakes	321	95994	3.3	33423	62571	33975	236	85	2.5	3.8	36	1.1
Tairawhiti	87	43971	2.0	18630	25341	20592	57	30	1.6	2.2	26	1.3
Taranaki	293	103023	2.8	16431	86592	15732	243	50	3.0	2.8	18	1.1
Whanganui	304	63594	4.8	15009	48585	15372	232	72	4.8	4.8	21	1.4
Mid Central	476	154986	3.1	30276	124710	27777	354	122	4.0	2.8	27	1.0
Hawkes Bay	843	143547	5.9	37908	105639	37380	688	155	4.1	6.5	74	2.0
Wairarapa	183	38208	4.8	5973	32235	6258	148	35	5.9	4.6	5	0.8
Hutt	607	131847	4.6	35988	95859	30447	429	178	4.9	4.5	43	1.4
Capital and Coast	1246	245880	5.1	72246	173634	47148	732	514	7.1	4.2	94	2.0
Nelson-Marlborough	513	122472	4.2	15795	106677	11211	436	77	4.9	4.1	20	1.8
West Coast	198	30294	6.5	3393	26901	2757	169	29	8.5	6.3	3	1.1
Canterbury	3484	427083	8.2	65943	361140	37425	2567	917	13.9	7.1	75	2.0
South Canterbury	313	52785	5.9	4371	48414	3219	271	42	9.6	5.6	9	2.8
Otago	1612	170739	9.4	20505	150234	12666	1361	251	12.2	9.1	38	3.0
Southland	573	103371	5.5	12381	90990	12255	498	75	6.1	5.5	21	1.7
Overseas	214						101				7	

Appendix Table 3 – Stent Operations: Figures for Last Complete Year of Data (2003)

District Health Board of Domicile	No of Stents 2003	Total Pop'n in DHB	No of Stents Per 1000 of Total Pop'n	Total Non-NZ Europ'n In DHB	Total NZ Europ'n In DHB	Total Maori & Pacific Island In DHB	No of Stents NZ Europ'n	No of Stents Non-NZ Europ'n	No of Stents Per 1000 of Non-NZ Europ'n	No of Stents Per 1000 of NZ Europ'n	No of Stents Maori & Pacific Island	No of Stents Per 1000 of Maori & Pacific
Northland	109	140127	0.8	46299	93828	43890	82	27	0.6	0.9	14	0.3
Waitemata	359	429756	0.8	131529	298227	72624	234	125	1.0	0.8	20	0.3
Auckland	309	367734	0.8	160797	206937	80370	166	143	0.9	0.8	39	0.5
C. Manukau	264	375531	0.7	185250	190281	143814	138	126	0.7	0.7	59	0.4
Waikato	239	317751	0.8	127470	190281	74454	182	57	0.4	1.0	22	0.3
Bay of Plenty	122	178161	0.7	47487	130674	45912	97	25	0.5	0.7	16	0.3
Lakes	68	95994	0.7	33423	62571	33975	53	15	0.4	0.8	11	0.3
Tairawhiti	23	43971	0.5	18630	25341	20592	17	6	0.3	0.7	6	0.3
Taranaki	51	103023	0.5	16431	86592	15732	43	8	0.5	0.5	5	0.3
Whanganui	64	63594	1.0	15009	48585	15372	46	18	1.2	0.9	5	0.3
Mid Central	84	154986	0.5	30276	124710	27777	61	23	0.8	0.5	8	0.3
Hawkes Bay	149	143547	1.0	37908	105639	37380	127	22	0.6	1.2	1	0.0
Wairarapa	30	38208	0.8	5973	32235	6258	25	5	0.8	0.8	2	0.3
Hutt	104	131847	0.8	35988	95859	30447	76	28	0.8	0.8	7	0.2
Capital and Coast	219	245880	0.9	72246	173634	47148	128	91	1.3	0.7	27	0.6
Nelson-Marlborough	107	122472	0.9	15795	106677	11211	91	16	1.0	0.9	9	0.8
West Coast	41	30294	1.4	3393	26901	2757	37	4	1.2	1.4	0	0.0
Canterbury	599	427083	1.4	65943	361140	37425	411	188	2.9	1.1	14	0.4
South Canterbury	59	52785	1.1	4371	48414	3219	46	13	3.0	1.0	4	1.2
Otago	244	170739	1.4	20505	150234	12666	200	44	2.1	1.3	10	0.8
Southland	109	103371	1.1	12381	90990	12255	91	18	1.5	1.0	5	0.4
Overseas	30						6	24			3	

Appendix Table 4 – Cumulative Figures for CABG Operations between 1995 and 2004

District Health Board of Domicile	No of CABGs 1995-2004	Total Pop'n in DHB	No of CABGs Per 1000 of Total Pop'n	Total Non-NZ Europ'n in DHB	Total NZ Europ'n in DHB	Total Maori & Pacific Island in DHB	No of CABGs NZ Europ'n	No of CABGs Non-NZ Europ'n	No of CABGs Per 1000 of Non-NZ Europ'n	No of CABGs Per 1000 of NZ Europ'n	No of CABGs Maori & Pacific Island	No of CABGs Per 1000 of Maori & Pacific
Northland	675	140127	4.8	46299	93828	43890	488	187	4.0	5.2	112	2.6
Waitemata	1831	429756	4.3	131529	298227	72624	1332	499	3.8	4.5	130	1.8
Auckland	1638	367734	4.5	160797	206937	80370	1049	589	3.7	5.1	230	2.9
C. Manukau	1528	375531	4.1	185250	190281	143814	969	559	3.0	5.1	278	1.9
Waikato	1419	317751	4.5	127470	190281	74454	1109	310	2.4	5.8	122	1.6
Bay of Plenty	844	178161	4.7	47487	130674	45912	592	252	5.3	4.5	62	1.4
Lakes	360	95994	3.8	33423	62571	33975	240	120	3.6	3.8	62	1.8
Tairawhiti	139	43971	3.2	18630	25341	20592	81	58	3.1	3.2	46	2.2
Taranaki	423	103023	4.1	16431	86592	15732	363	60	3.7	4.2	17	1.1
Whanganui	218	63594	3.4	15009	48585	15372	163	55	3.7	3.4	15	1.0
Mid Central	446	154986	2.9	30276	124710	27777	340	106	3.5	2.7	27	1.0
Hawkes Bay	681	143547	4.7	37908	105639	37380	548	133	3.5	5.2	67	1.8
Wairarapa	141	38208	3.7	5973	32235	6258	119	22	3.7	3.7	9	1.4
Hutt	495	131847	3.8	35988	95859	30447	319	176	4.9	3.3	51	1.7
Capital and Coast	717	245880	2.9	72246	173634	47148	410	307	4.2	2.4	52	1.1
Nelson-Marlborough	569	122472	4.6	15795	106677	11211	493	76	4.8	4.6	15	1.3
West Coast	153	30294	5.1	3393	26901	2757	133	20	5.9	4.9	3	1.1
Canterbury	2007	427083	4.7	65943	361140	37425	1561	446	6.8	4.3	59	1.6
South Canterbury	251	52785	4.8	4371	48414	3219	217	34	7.8	4.5	2	0.6
Otago	1116	170739	6.5	20505	150234	12666	953	163	7.9	6.3	22	1.7
Southland	524	103371	5.1	12381	90990	12255	433	91	7.3	4.8	29	2.4
Overseas	245						152	93				

Appendix Table 5 – CABG Operations: Figures for Last Complete Year of Data (2003)

District Health Board of Domicile	No of CABGs 2003	Total Pop'n in DHB	No of CABGs Per 1000 of Total Pop'n	Total Non-NZ Europ'n in DHB	Total NZ Europ'n in DHB	Total Maori & Pacific Island in DHB	No of CABGs NZ Europ'n	No of CABGs Non-NZ Europ'n	No of CABGs Per 1000 of Non-NZ Europ'n	No of CABGs Per 1000 of NZ Europ'n	No of CABGs Maori & Pacific Island	No of CABGs Per 1000 of Maori & Pacific
Northland	86	140127	0.6	46299	93828	43890	52	34	0.7	0.6	28	0.6
Waitemata	190	429756	0.4	131529	298227	72624	115	75	0.6	0.4	23	0.3
Auckland	173	367734	0.5	160797	206937	80370	91	82	0.5	0.4	31	0.4
C. Manukau	181	375531	0.5	185250	190281	143814	107	74	0.4	0.6	39	0.3
Waikato	145	317751	0.5	127470	190281	74454	114	31	0.2	0.6	12	0.2
Bay of Plenty	93	178161	0.5	47487	130674	45912	73	20	0.4	0.6	8	0.2
Lakes	37	95994	0.4	33423	62571	33975	23	14	0.4	0.4	9	0.3
Tairawhiti	18	43971	0.4	18630	25341	20592	10	8	0.4	0.4	7	0.3
Taranaki	41	103023	0.4	16431	86592	15732	36	5	0.3	0.4	1	0.1
Whanganui	39	63594	0.6	15009	48585	15372	32	7	0.5	0.7	2	0.1
Mid Central	71	154986	0.5	30276	124710	27777	57	14	0.5	0.5	6	0.2
Hawkes Bay	83	143547	0.6	37908	105639	37380	62	21	0.6	0.6	15	0.4
Wairarapa	19	38208	0.5	5973	32235	6258	17	2	0.3	0.5	1	0.2
Hutt	59	131847	0.4	35988	95859	30447	39	20	0.6	0.4	10	0.3
Capital and Coast	81	245880	0.3	72246	173634	47148	42	39	0.5	0.2	14	0.3
Nelson-Marlborough	72	122472	0.6	15795	106677	11211	65	7	0.4	0.6	1	0.1
West Coast	13	30294	0.4	3393	26901	2757	12	1	0.3	0.4	0	0.0
Canterbury	239	427083	0.6	65943	361140	37425	174	65	1.0	0.5	10	0.3
South Canterbury	23	52785	0.4	4371	48414	3219	13	10	2.3	0.3	2	0.6
Otago	117	170739	0.7	20505	150234	12666	104	13	0.6	0.7	1	0.1
Southland	67	103371	0.6	12381	90990	12255	51	16	1.3	0.6	7	0.6
Overseas	18						1	17			12	

Appendix Table 6 – The Spread of Technology: The Case of Stents

Facility		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Auckland National Womens	No of Stents	153	259	138	0	0	0	0	0	0	0
	Length of Stay	5.48	4.05	3.07							
	Average Age	58.81	61.19	61.41							
	Clinical Complications										
Auckland Greenlane	No of Stents	0	0	371	537	611	705	785	897	489	0
	Length of Stay			3.28	3.31	2.61	2.61	2.45	2.49	2.48	
	Average Age			60.36	59.93	59.73	60.48	61.54	62.17	62.05	
	Clinical Complications				1.7	1.72	1.78	1.80	1.84	1.74	
Auckland	No of Stents	0	0	0	5	3	6	0	2	0	0
	Length of Stay				3.75	4.67	4.50		4.50		
	Average Age				61.75	62.33	56.17		59.50		
	Clinical Complications				1	1	1.5		2.5		
Auckland City Hospital	No of Stents	0	0	0	0	0	0	0	0	582	565
	Length of Stay									2.38	2.95
	Average Age									60.54	61.73
	Clinical Complications									1.82	1.78
Capital & Coast Wellington	No of Stents	7	67	194	342	355	429	649	679	737	404
	Length of Stay	4.86	2.36	2.39	2.45	2.07	1.87	1.55	1.59	1.48	1.85
	Average Age	56.38	58.64	60.09	61.88	61.4	60.77	61.55	61.54	61.89	61.34
	Clinical Complications				1.28	1.37	1.50	1.36	1.35	1.40	1.54
Capital & Coast Kenepura	No of Stents	0	0	0	0	0	1	0	0	0	0
	Length of Stay						13				
	Average Age						80				
	Clinical Complications						4				
Canterbury Christchurch	No of Stents	1	5	12	156	549	590	612	649	704	359
	Length of Stay	8	5.20	7.33	7.46	5.67	6.24	5.5	5.32	4.76	5.2
	Average Age	42	58.00	54.17	60.44	62.56	63.02	62.64	62.09	63.43	63.06
	Clinical Complications				1.73	1.69	1.6	1.81	1.76	1.97	1.96
Otago Dunedin	No of Stents	55	208	326	294	319	320	312	317	363	184
	Length of Stay	6.35	4.26	4.08	3.19	3.38	4.04	3.37	3.58	3.48	3.72
	Average Age	63.16	58.41	61.08	60.34	61.28	61.77	62.8	63.13	64.62	63.76
	Clinical Complications				1.70	1.84	1.7	1.86	1.86	1.77	1.85
Waikato	No of Stents	9	43	109	163	261	296	399	439	496	323
	Length of Stay	9.22	5.72	5.75	5.02	4.88	4.67	4.57	4.49	4.07	4.03
	Average Age	58.22	57.79	59.3	60.15	62.27	61.74	61.99	60.71	61.67	62.18
	Clinical Complications				1.58	1.88	1.73	1.62	1.7	1.56	1.65
Manukau	No of Stents	0	0	1	9	19	10	14	8	4	5
	Length of Stay			8	5	5.26	4.70	5.43	5.75	8.25	7.60
	Average Age			57	59.33	55.37	56.90	58.29	57.5	60.25	67.40
	Clinical Complications				1.33	1.74	1.20	1.29	2.13	1.00	2.00

Facility		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Mid Central Palmerston North	No of Stents	0	0	0	1	0	0	0	0	1	0
	Length of Stay				2					1	
	Average Age				63					79	
	Clinical Complications				2					1	
Hutt Valley Hutt Hospital	No of Stents	0	0	0	0	2	3	11	0	0	1
	Length of Stay					21	5.33	3			2
	Average Age					67.50	52.67	54.00			50
	Clinical Complications					3.00	1.33	1.09			1
Nelson Marlborough	No of Stents	0	0	0	0	0	0	0	1	0	0
	Length of Stay								1		
	Average Age								70		
	Clinical Complications								3		
Mercy, Auckland	No of Stents	0	0	0	0	0	0	0	0	7	0
	Length of Stay									0	
	Average Age									63.86	
	Clinical Complications									0.43	

Appendix Table 7 – The Use of an Older Technology across Different DHBs: The Case of CABGs

Facility		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Auckland	No of CABGs	502	467	641	697	702	670	776	817	681	281
	Length of Stay	13.24	13.36	12.28	12.32	11.74	11.99	11.02	11.64	11.88	13.46
	Average Age	62.64	64.21	63.41	63.87	64	64.34	65.18	64.87	64.34	65.42
	Clinical Complications				2.68	2.65	2.71	2.56	2.63	2.62	2.87
Capital & Coast	No of CABGs	233	207	213	266	295	465	318	338	397	159
	Length of Stay	12.82	12.8	12.97	11.52	10.46	9.53	10.26	10.99	9.87	9.84
	Average Age	62.34	62.6	63.66	64.29	63.46	63.54	63.49	65.21	65.13	63.91
	Clinical Complications				2.05	1.7	1.72	2.2	1.99	2.19	2.15
Canterbury	No of CABGs	0	0	5	141	224	263	256	244	275	141
	Length of Stay			7.6	15.79	18.38	16.52	17.07	12.32	14.72	16.1
	Average Age			62.2	63.8	65.11	65.31	65	64.65	65.29	64.54
	Clinical Complications				2.76	2.69	2.42	2.5	2.46	2.67	2.62
Otago	No of CABGs	371	349	429	281	128	35	17	156	186	85
	Length of Stay	13.67	13.69	12.22	13.06	11.96	11.14	9.59	13.23	16.52	13.45
	Average Age	63.75	63.58	64.81	64.65	65.08	66.89	67.47	66.99	66.03	65.69
	Clinical Complications				2.83	3.01	2.94	2.11	2.67	3.01	2.72
Waikato	No of CABGs	284	355	317	287	316	341	398	339	326	153
	Length of Stay	12.17	12.26	14.95	14.45	14.06	14.54	14.1	13.74	14.7	16.11
	Average Age	63.16	61.43	64.39	63.75	64.47	63.24	63.63	64.18	64.58	64.6
	Clinical Complications				2.39	2.59	2.4	2.26	2.16	2.47	2.57
Manukau	No of CABGs	0	0	1	0	0	0	0	0	0	0
	Length of Stay			7							
	Average Age			66							
	Clinical Complications										
Hawkes Bay	No of CABGs	0	0	0	0	0	0	0	0	0	0
	Length of Stay										
	Average Age										
	Clinical Complications										
Wakefield	No of CABGs	24	0	0	0	0	0	2	0	0	0
	Length of Stay	8.42						7.5			
	Average Age	60.39						58			
	Clinical Complications							0			
Taranaki	No of CABGs	0	0	0	1	0	0	0	0	0	0
	Length of Stay				10						
	Average Age				76						
	Clinical Complications										
Mercy, Auckland.	No of CABGs	0	0	0	7	0	0	0	0	0	0
	Length of Stay				8.86						
	Average Age				63.71						
	Clinical Complications										

Facility		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Heart Surgery Sth Island	No of CABGs	0	0	0	0	95	188	197	77	0	0
	Length of Stay					8.52	9.87	9.33	8.9		
	Average Age					65.59	65.09	66.66	67.27		
	Clinical Complications					2.45	2.79	2.74	2.75		
St Georges	No of CABGs	0	0	0	0	0	0	0	0	0	1
	Length of Stay										22
	Average Age										69
	Clinical Complications										2