CORONARY INTENSIVE CARE FOR CARDIAC INFARCTION: A CASE STUDY OF THE DIFFUSION OF HIGH TECHNOLOGY IN THE AUSTRALIAN HOSPITAL SECTOR*

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Although technological change processes in agriculture and industry have been extensively studied, studies of technological change processes in the service sector are, to date, limited in number. In this paper, findings of a case study of the diffusion of coronary care facilities in the Australian hospital sector are presented and discussed. Comparisons are drawn with other studies of innovation and diffusion in both profit and not-for-profit settings in this country and overseas. A review of the history of treatment for coronary heart disease serves to emphasise that technologies, thought to be of worth, are too often introduced only to be later discarded. Comprehensive technology assessment is proposed as a viable alternative to the ad hoc approach which presently characterises the adoption of medical innovations.

Keywords: diffusion, coronary care, medical technological services

INTRODUCTION

Since the seminal papers by Abramovitz and Solow supplied evidence that technological change was a major determinant of economic growth,[1] widespread interest has been shown in technological change processes and especially in the application into common use of product and process innovations.[2] Ramifications of technological change have been discussed by those concerned about its employment and societal impacts.[3] Technological change processes in both agriculture and industry have been extensively studied.[4] Australian contributions include Stubbs' study of the origins and use of innovations in Australian manufacturing companies and a study commissioned by the Office of Secondary Industry, which compared the rate of diffusion of new technology within ten Australian

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manufacturing industries with that in six other advanced industrial nations.[5] Technological change processes in such diverse industries as the Australian sugar industry and banking have also been studied, as have the diffusion and employment effects of word processing equipment.[6]

Studies of technology diffusion in the health service sector reflect concern about significant real increases in national expenditure on medical care in recent decades.[7] However, although interest in the dynamics of health services sector innovation is growing, contributions remain limited, and relate mainly to overseas experience with new medical technologies. Indeed, the bulk of health services diffusion research from all traditions examines American and European experience with medical innovations.[8] Piachaud's questionnaire survey of the diffusion of high technologies in medicine among less-developed countries is one of the few exceptions and reflects general concern that LDCs may utilize less than appropriate technologies in medicine, as in industry.[9] This case study of the adoption of coronary intensive care facilities examines health services sector diffusion in the Australian context. Conclusions about the origins, dissemination and use of a significant medical innovation are compared with studies of technological change processes in industrial settings, with other Australian studies of sources and rates of acceptance of innovation, and with other findings about health services innovation and diffusion.[10]

HOSPITAL SECTOR DISSEMINATION OF CORONARY INTENSIVE CARE FACILITIES.

In the 1950s, a series of advances, notable among which were defibrillation, closed-chest cardiac massage and cardiac pacing, made practicable the treatment of acute myocardial infarction (AMI) in the early stages.[11] To ensure the speedy application of the new techniques, at-risk individuals were admitted to special wards where the electrocardiogram could be monitored continuously for irregularities. Coronary care units (CCUs) were established in the USA and Canada in 1962 by Day and his colleagues at Bethany Hospital in Kansas City, Meltzer and Kitchell in Philadelphia, and Brown and Macmillan in Toronto.[12] In Australia, Julian and his colleagues established a CCU at Sydney Hospital in November of 1962,[13] and a second unit was set up at the Royal Melbourne Hospital in March of 1963.[14]

Further information about coronary care facilities provided by Australian hospitals was obtained from two sources — (1) the annual surveys of hospitals and health services published by the University of New South Wales School of Health Administration, and (2) a special survey of Australian coronary care units, covering the first 10 years of

their establishment. The School of Health Administration surveys hospitals and health services throughout Australia and compiles information, including details of operating statistics, staff, cases treated and facilities provided, in annual Yearbooks. Institutions responding to the surveys are grouped by location (State and region) and type of control (public, private, repatriation), and individual details of each hospital's operations are given. The first survey conducted by the School, the details of which related to the period up until July 1966, was published in 1967. The latest date for which survey data are available is the financial year ended 30 June 1981.

Although the Yearbooks are a valuable source of base-line data on Australian health services, queries regarding the provision of coronary care facilities were not included in questionnaires prepared by the School of Health Administration until the publication of the 1970 Yearbook, which, in any case, omitted details of facilities provided by Queensland hospitals. After this date, the Yearbooks were not published again until 1973. In order to present a complete picture of the diffusion process, including the early stages, figures for the period 1962-1972 were drawn from a survey of coronary care units conducted on behalf of the National Heart Foundation of Australia. Figures pertaining to the latter stages of the diffusion process were then derived from the survey data published by the School of Health Administration. For the years in which the two sets of data overlap, the figures are sufficiently alike for it to be concluded that, when combined, information from the two sources provides a reasonably accurate picture of the diffusion process. Gaps in the data reflect years during which no surveys were conducted.

Of those hospitals responding to surveys of hospital facilities to 30 June 1981, a total of 182 reported that they had established coronary care unit facilities. Table 1 shows the overall pattern of adoption by hospitals reporting CCUs on their premises over the period 1962-1980/81. The number of adopting hospitals at the final date for which information is available was computed as an arbitrary technological ceiling (100 per cent). The procedure employed is identical to that used by Russell in her survey of hospital technologies in the United States.[15]

Figure 1 indicates the percentage of approved hospitals within defined size groups establishing coronary care facilities from 30 June 1969 to 30 June 1981, the period during which coronary intensive care units were included among hospital and health services facilities surveyed by the School of Health Administration. Because the School of Health Administration also collected additional survey data on the number of beds in hospitals to which questionnaires were sent, it was possible to group hospitals by size, measured by bed capacity.[16] No similar classification of hospitals was possible for earlier time periods.

The denominator used equals the number of approved hospitals (public, private and repatriation hospitals approved under the Health Insurance Act) within each of the specificed size groups, as at 30 June 1978. The source of this information was the Fourth Annual Report of the Health Insurance Commission.

TABLE 1

Cumulative Number and Percentage of Hospitals with Coronary Care Facilities on Premises 1962-1980/81

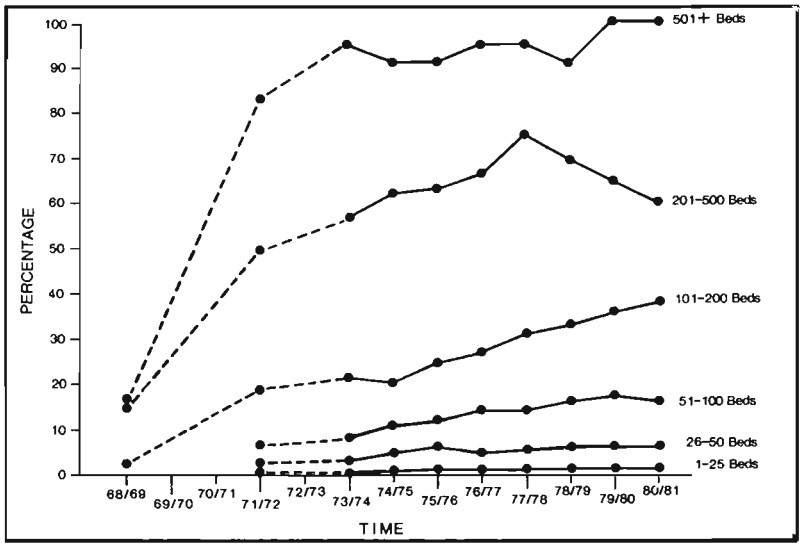
Year	(Number)	(%)
1962	1	0.55
1963	2	1.09
1964	2	1.09
1965	4	2.2
1966	10	5.5
1967	16	8.8
1968	30	16.5
1969	38	20.88
1970	56	30.77
1971	76	41.76
1972	84	46.15
1972/73*	—	—
1973/74	127	69.78
1974/75	139	76.37
1975/76	151	82.97
1976/77	159	87.36
1977/78	170	93.41
1978/79	173	95.05
1979/80	182	100.00
1980/81	182	100.00

Note: * The School of Health Administration did not survey hospital facilities for the year ended 30 June 1973. Figures from this date onwards relate to the financial year.

Source: **1962-1972:** A survey conducted for the National Heart Foundation of Australia, published as K.H. McLean, C. Penington and J.G. Sloman, 'The Australian coronary care unit review, 1970', *Medical Journal of Australia,* 1, 14 April 1973, pp. 753-62.
1973/74-1980/81: Derived from the University of New South Wales, School of Health Administration's surveys of hospital facilities, as published in the Australian Hospitals and Health Services Yearbooks, 1975/76 to 1982/83.

FIGURE 1

Percentage of Approved Hospitals, with Coronary Care Facilities on Premises, by Size of Hospital, 1968/69-1980/81



Source: Derived from the University of New South Wales, School of Health Administration's surveys of hospital facilities, as published in the Australian Hospitals and Health Services Yearbooks, 1970 to 1982/83. Figures relate to the financial year.

- - - - indicates breaks in the continuity of survey data.

It can be seen that large hospitals adopted the innovation ahead of smaller hospitals. Not until 1971-1972 were reports of the establishment of CCUs in hospitals of 100 or fewer beds received. Large hospitals have also adopted the innovation at a faster rate than have hospitals within smaller size ranges. As of mid 1969, no hospitals with fewer than 101 beds, and only 2.3 per cent of hospitals with 101-200 beds, reported a coronary care unit on their premises. 15 per cent of hospitals with 201-500 beds, and a little over 16 per cent of hospitals of 501 or more beds had adopted the innovation. By 1972, ten years after the establishment of the first coronary care units in Sydney and Melbourne, half of the hospitals with 201 to 500 beds, and 83.3 per cent of hospitals with 501 or more beds reported a coronary care unit on their premises. A little less than a fifth of hospitals of 101-200 beds had established coronary care units, while in the smallest

size groups, only some 7 per cent of hospitals of 51-100 beds, 2 per cent of hospitals of 26-50 beds, and less than 1 per cent of hospitals of 1 to 25 beds had. To date, it is only hospitals of 501 or more beds that all report establishment of CCUs.

THE ROLE OF CORONARY INTENSIVE CARE

Although coronary care units are a well-established innovation, their use has long been the subject of controversy.[17] The philosophy of special care units for patients with coronary heart disease (CHD) had as its objective reductions in mortality through the initiation of successful resuscitative measures after cardiac arrest, and through the correction or prevention of complications, including arrhythmias, hypotension, cardiac failure and cardiogenic shock.[18]

MEASURES OF EFFECTIVENESS

Measures of the effectiveness of coronary care have included analyses of mortality rates of patients cared for in individual CCUs,[19] comparisons of mortality rates before and after the establishment of CCUs,[20] comparisons of mortalities between hospitals with and without coronary care units,[21] comparisons of mortalities between patients assigned, on the basis of bed availability, to a CCU or to a ward,[22] comparisons of mortality rates between patients managed at home and in hospital[23] and community-wide investigations.[24]

Analyses of in-hospital fatalities and time trends

Non-experimental analyses of fatalities among patients treated in CCUs have demonstrated lowered mortality rates of the order of one third on average.[25] However, analyses of time trends in the prognoses of individuals with AMI treated in hospital have produced conflicting results. A study of in-hospital fatality rates over time, based on preliminary data from eight Baltimore hospitals and 321 cases, reported reductions in the mortality from first myocardial infarctions from 33.3 per cent in 1966-67 to 23 per cent in 1971, and from 34.7 per cent to 26.7 per cent for recurrent myocardial infarctions. The reductions, which remained even after adjustments were made for age and clinical complications, were attributed to the benefits of new therapeutic techniques.[26]

In England and Wales, hospital admission rates for acute coronary heart disease rose steeply during the period 1963-1971. However, although there was a striking and steady decline in case fatality ratios for hospital admissions among both men and women, coronary heart disease mortality ratios for both deaths in hospital and total deaths remained stable. Rose concluded that, although declines in hospital fatality rates might be attributable to advances in coronary intensive

care, they were more likely to have resulted from the admission of more mild cases.[27]

Hunt, Sloman and others compared three groups of patients who were admitted to the Royal Melbourne Hospital CCU over the time periods 1963-1967, 1969-1970 and 1974-1975 in order to determine whether outcomes had improved over the 12-year interval. Reductions in mortality at 12 months were seen among patients with either mild or severe infarctions between 1969-1970 and 1974-1975. The mortality associated with arrhythmias had also decreased over this period. A comparison of mortality rates in patients with similar risk factors in each of the three groups indicated that there had been reductions in mortality over the 12-year period in patients with each of the risk factors.[28] However, whether decreases in mortality were attributable to changes in the characteristics of patients admitted to the coronary care unit, as commentators Thompson[29] and Goble[30] suggested was likely, to improved treatment within the CCU, and later, or to changes in the natural history of CHD, could not be definitively ascertained.

In-hospital fatalities before and after the advent of hospital coronary care units

Comparisons of mortality rates before and after the establishment of CCUs have yielded results both favourable and unfavourable to their continued use. Chapman reported a fall in the overall mortality rate from acute myocardial infarction from a mean of 36 per cent during the five years before the establishment of a CCU to 24 per cent in an unselected hospital series during the first nine months after a CCU was opened at Newcastle Hospital in 1968. Prognostic factors were on the whole similar for cardiac patients admitted to the CCU and those admitted in the twelve months before its opening.[31] However, a comparison of fatalities from AMI before and after the establishment of a coronary care unit in a busy Scandinavian hospital found no marked diferences between the two groups.[32]

Comparisons of fatalities from AMI in coronary care units and on general medical wards

Comparisons of patients allocated, on the basis of bed availability, to a CCU or to a ward have likewise produced results which are far from unequivocal. Approximately half of the cases with acute myocardial infarction admitted to Toronto General Hospital in 1968 were admitted to a general medical ward instead of to the coronary care unit because of a shortage of beds. The mortality amongst those admitted to the CCU was 15.6 per cent compared with 27 per cent on the general medical ward. The proportion of individuals successfully resuscitated in the coronary care unit was twice that in the general medical ward.[33]

In marked contrast are the findings of the study conducted by Hill, Holdstock and Hampton.[34] Of 1480 cases with diagnoses of definite or probable myocardial infarction admitted to two teaching hospitals during a 32 month-period, 483 were placed in a ward due to a shortage of beds in CCUs while the remainder were admitted to a coronary care unit. The mortality rates for those patients in the age group 66 and over were virtually identical, irrespective of whether they were admitted to a ward (32 per cent) or a coronary care unit (31 per cent). The mortality rates for those patients in the age group 65 and under were slightly higher for those in the ward (18 per cent) than for those in the CCU (15 per cent), but not to a degree that could be termed statistically significant.

When 11 hospitals, including the Royal Melbourne Hospital, participated in a collaborative project organised by the US Public Health Service, the median overall hospital mortality rate reported was 26.6 per cent. Mortality rates in the coronary care units and the wards were no different, hospitals in the study reporting instead an overall decrease in mortality rates of 10 per cent following the establishment of CCUs. Sloman attributed this to a spill-over effect, whereby information gained from experience with the coronary care concept favourably influenced the care of patients elsewhere in the hospital.[35]

Home versus hospital care

Comparisons of home versus hospital care for AMI suggest that home care is as good as, and in some cases superior to, care in a CCU. Included among these studies are the only randomized trials of the coronary care concept. Preliminary publications by Mather and his co-workers reported comparisons between home and hospital care for 343 males with AMI. Those patients admitted to hospital spent at least 48 hours in a CCU. Mortality rates between the two random groups were similar.[36] Final conclusions from a study of 450 patients with AMI, randomly allocated to home or to hospital care, were published in 1976. Randomized treatment groups were comparable with respect to age distribution, past history of cardiovascular disease and hypotension on initial examination. At 28 days, mortality rates were 14 per cent (hospital care) compared with 12 per cent (home care). At 330 days, mortality rates were 27 per cent (hospital care) compared to 20 per cent (home care). Although death rates were marginally higher for hospital patients, the differences observed were not statistically significant. However, home care appeared particularly beneficial for patients 60 years and older who did not suffer initial hypotension.[37]

Hill, Hampton and Mitchell conducted a further randomized comparison of home and hospital treatment for patients with

suspected AMI, the results of which were published in 1978. A hospital-based team, comprising a doctor and a coronary care nurse, was sent to the homes of patients with suspected myocardial infarction in response to requests by general practitioners participating in the study. In all, 264 patients with suspected AMI were randomly allocated to either home or hospital care. There was no significant difference between the two groups with respect to presence or absence of previous infarction or angina, cardiac enzyme levels, time lapse between onset of symptoms and first call to a general practitioner for help and time lapse between onset of symptoms and arrival of the coronary care team at the home. Nor did the six-week mortality rate differ significantly between the two random groups. Patients excluded from the trial on social or medical grounds were found to have a higher death rate than those patients who were randomized, indicating that a hospital-based team, called to the home, can successfully identify those high-risk patients for whom transfer to the hospital is indicated.[38]

In Australia, Victorian general practitioners participated in a co-operative study which compared a group of patients cared for initially at home but eventually referred to hospital with a group of patients treated wholly at home. Of 131 cases registered in the study and which fulfilled the criteria of myocardial infarction set down by the National Heart Foundation Coronary Care Survey, 91 were initially treated at home and later referred to hospital, while 40 were treated wholly at home. Of the 91 patients referred to hospital, 51 were treated in a coronary care unit. Although there were no statistically significant differences between the two groups with respect to age and sex, there was a greater incidence of a past history of myocardial disease in the group treated only partially at home, the difference here being statistically significant. The group of patients eventually sent to hospital also had a significantly higher incidence of arrhythmias.

Statistical analysis revealed no differences in the incidence of cardiovascular complications between the two groups before six weeks, or from six weeks to 12 months. However, there was a statistically significant difference between the two groups with respect to complications occurring in the total period up to 12 months, with a larger number of complications being evident in the group referred to hospital. There was no statistically significant difference between the two groups with respect to mortality rates at 12 months. The conclusions of the study, published in the *Australian Family Physician,* were that those patients with conditions which required hospital treatment were in fact sent to hospital. Those selected patients who were treated wholly at home fared as well as their hospital counterparts.[39]

Community-wide investigations

Community-wide investigations have produced yet further divisions of opinion within the medical fraternity. A seven-year retrospective study published by Stillerman in 1970 found mortality from CHD within an American community not to have been significantly reduced by the advent of two hospital CCUs in 1966.[40] Rose concluded that, despite the widespread establishment of hospital coronary intensive care facilities, mortality from coronary heart disease remained stable in England and Wales during the period 1963-1971.[41]

Although further community-wide investigations have reported reductions in the mortality from CHD, the reasons for the declines remain controversial. Reader, in Australia, noted significant upward trends in mortality rates from CHD for males from 1950 until 1966-67, at which point mortality rates stablizied and then began to decline.[42] Although Reader attributed the declines wholly to the benefits of coronary intensive care, Christie concluded that an equally, if not more, important factor was a reduction in the natural incidence of CHD attendant upon a decline in the severity of the risk factor, hypotension, over the period 1950-1970.[43] Cilento concluded that changes in the natural history of CHD, through risk factor reduction, were attributable to improvements in individuals' dietary habits.[44]

In the United States, declines in the age-specific mortality rates from CHD during the period 1963-1975 coincided with major changes in the dietary habits of Americans. Per capita consumption of tobacco, butter, milk, cream and animal fats decreased, while the consumption of vegetable fats and vegetable oils increased.[45] Observed declines in the mortality from CHD in England, Wales and Scotland between 1972 and 1976 were attributed to decreases in consumption of tobacco by males together with a general decline in the use of animal fats, eggs and sugar over the time period 1968-1976.[46]

Reflections on intermediate and mobile coronary care

Observations that patients discharged from the standard coronary care unit continued to be at high risk from AMI led to the establishment of the intermediate[47] or post-coronary[48] care unit (ICCU or PCCU) to which individuals who still need medical surveillance, supervision and care in the later stages of recovery may be admitted. Mobile coronary care units (MCCUs) have been established in many Australian capital cities and units are often manned by ambulance personnel specially trained in emergency care for cardiac complaints.[49] Coronary care facilities thus emphasise continuity of care in both the pre- and post-coronary care phases.

However, observations on intermediate and mobile coronary care cast doubt on the validity of the coronary care system as a whole. Prolonged monitoring of two or more weeks' duration, as envisaged by advocates of intermediate or progressive coronary care, may not be necessary in all cases. On the basis of a study of 466 cases admitted to the coronary care unit at a Belfast hospital in 1972, Wilson and Pantridge concluded that a third constituted a low risk group which did not require monitoring after 48 hours.[50] Weinberg found the introduction of intermediate coronary care not to be associated with reductions in mortality even among categories of high-risk individuals.[51]

Mobile coronary care has been deemed to be of significant value in correcting ventricular fibrillation, a major cause of death outside hospital.[52] A study by the Cardiovascular Units of St. Vincent's and Prince of Wales Hospitals, Sydney, reported that, of the 116 calls received during the first 21 months of operation of a modified coronary ambulance service, 52 per cent were reached within 15 minutes, and all within 30 minutes of the call, and 105 cases (90 per cent) reached hospital alive.[53] Crampton and his colleagues reported reductions in annual ambulance (62 per cent), prehospital (26 per cent) and community coronary death rates (15 per cent) following the establishment of a community-wide cardiopulmonary resuscitation and emergency cardiac care system in Charlesville, Virginia.[54]

Yet the six-month feasibility study of a MCCU in an urban European community, conducted by Siltanen, Sundberg and Hytönen, found that the MCCU was able to reach in time only about half of those cases of cardiac arrest in which medical aid was summoned in time, or less than 5 per cent of all cases of unexpected cardiac arrest in the community as a whole. When MCCU patients and their matched pairs from a period two to eight months before the introduction of mobile coronary care were compared, the mortality rates for the two groups were found to be similar.[55] Comparisons of special cardiac ambulance services with routine services suggest that although special services undoubtedly save some lives, low mortality among patients with heart attacks transported to hospital by a cardiac ambulance may be the result of unintentional selection of low-risk cases, and that little overall reduction in community mortality can be anticipated through provision of such services.[56]

DISCUSSION

Lag times

Stubbs, on the basis of his survey of 45 manufacturing companies in Australia, concluded that there were typically lags between the origin

of an innovation overseas and its adoption by manufacturing industries in Australia.[57] In a study by International Technical Services of the rate of diffusion of new technology within Australian industry, it was found that, of the 16 innovations in five manufacturing industries for which information on the country of origin and the date of first commercial installation of the product or process in Australia was available, in only two cases were lags of less than three years reported.[58] In comparison, coronary care facilities are an example of an innovation whose lag time before introduction into Australia (less than one year) was short indeed. The very short lag time is indicative of the value Australian physicians place on quality medical care.

Technological leaders and followers in the medical innovation diffusion process

Findings from the case study enable some conclusions to be drawn about technological leaders and followers in the medical diffusion process. Large hospitals were the earliest to adopt coronary care facilities. There are good reasons why large hospitals should be the leaders or innovators, while small hospitals are the followers or laggards. Amongst hospitals in the size range 501 or more beds are to be found the major Australian research-teaching hospitals, as well as other of the major metropolitan hospitals. Such hospitals, especially research-teaching hospitals, constitute centres of excellence within the community and experience strong pressures to remain abreast of major medical advances, and to innovate. The observed relationship among size, willingness to adopt new items and speed of implementation has been noted in other studies of health innovation and is comparable with some findings about diffusion in the industrial sector.[59] Large firms tend to be the technically progressive innovators, and innovations are more rapidly adopted by large firms.

Determination of diffusion patterns

The standard diffusion, or contagion model, which has its origins in the biological sciences' theory of epidemics, postulates spread within a defined population of potential adopters. Diffusion is seen as a learning process. As early users gain experience with the technique, evidence accumulates and risk is reduced. Others then become increasingly more willing to adopt the innovation. The standard pattern of diffusion over time, as predicted by traditional theory, is thus described by an S-shaped or sigmoid growth curve. Diffusion begins slowly and then accelerates. Though progress continues, it does so at a decreasing rate, tapering off as saturation is approached. Either a cumulative normal distribution function or a logistic function describes the growth process.[60]

Determination of spread within a potential population implies that a denominator or universe be chosen as a basis of comparison.[61] An arbitrary ceiling may be represented where the diffusion process is complete, or largely so. However, to conclude that the dissemination of a technology is nearing its end, the technology studied generally must be one which has been in use for many years.[62] For example, in Mansfield's study of the rate at which 12 important innovations were diffused throughout firms in four industries, it was found that it took 20 years or longer for all major firms to adopt several of the innovations and in the case of only three innovations had all major firms installed them within ten years.[63] Dispersion of CCUs over a lengthy period — 1962-1980/81 — is characterised by the initial establishment of only a few prototype coronary care units, increases in the numbers of adopting hospitals as knowledge about the innovation disseminated, and a slowing of growth towards the end of the time series. The spread of CCUs through hospitals within the largest size range is now complete, and the proportion of small hospitals reporting coronary care units on premises has remained relatively stable for several years. Good fits to a logistic model were obtained when the observed data on diffusion were evaluated by the Chi-square goodness of fit test. These results indicate that the temporal diffusion of coronary intensive care facilities in the Australian hospital sector follows the conventional pattern predicted by diffusion theory.

Comparisons can be drawn with other studies of health innovation diffusion. Atypical diffusion processes are not unknown in the health service sector. Coleman, Katz and Menzel found that physicians who were poorly integrated into their professional community adopted the drug gammanym at a more constant rate than did physicians well integrated into their social and professional communities, among whom adoption more closely followed a standard S-shaped pattern.[64] Kaluzny and others analysed the implementation of health services, including home health, family planning, medical social work, rehabilitation and mental health services in a random sample of short-term hospitals in the United States. When implementation rates for all health services programmes in hospitals of more than 500 and fewer than 500 beds were graphed, they approximated the typical diffusion curve. However, when the data were evaluated by means of a Chi-square goodness of fit test, implementation rates failed to approximate normal distributions.[65] Chemotherapy diffusion curves computed by Warner were found to be decidedly atypical. For chronic leukaemias, no preferred fit could be obtained to a diffusion curve which vacillated gradually upwards.[66] In contrast, in Russell's study of medical advances in use in the United States, data on the spread of organizational, diagnostic and therapeutic hospital technologies

showed the conventional slow start, followed by acceleration, and then later by decline and levelling off.[67]

Medical innovation and patient benefit

In the literature on diffusion research, several factors have been advanced to explain why, and at what rate, innovations are adopted. They include the advantages associated with an innovation's use, the ease with which the innovation can be understood, and the ease with which it may be implemented on a trial basis.[68] Theorists have suggested that medical advantage could be expected to assume a major significance in health care technology diffusion.[69] Yet a review of the history of treatment for myocardial infarction indicates the ambiguous benefits often associated with widely-diffused medical innovations.

Evidence in favour of the use of anticoagulant therapy in the treatment of coronary thrombosis with myocardial infarction was first reported in 1948 by a committee of the American Heart Association which found mortality in a control group to be 24 per cent, compared with only 15 per cent in a group receiving both conventional methods of treatment and anticoagulant therapy.[70] Tulloch and Gilchrist reported that anticoagulant therapy halved mortality during the first six weeks after AMI.[71] However, on the basis of a study of 543 cases of AMI admitted to the Radcliffe Infirmary, Oxford between 1940 and 1954, Honey and Truelove concluded that, although anticoagulant therapy reduced the risk of fatal pulmonary embolism, its value in the acute phase of AMI was otherwise limited.[72] The widespread use of anticoagulant therapy was ultimately discontinued when the results of properly designed studies suggested its use for AMI was not indicated. In a controlled series reported by Hilden, Iverson, Raaschou and Schwartz, although reductions in deaths from thromboembolic incidents were found to have occurred among the group treated with anticoagulants, death rates among control cases (25 per cent) and treated cases (23 per cent) were similar.[73] A controlled trial conducted by the Working Party on Anticoagulant Therapy found no significant differences between death rates in a high-dosage group (16 per cent) and a low-dosage group (18 per cent) at 28 days.[74]

A controlled sequential trial by Mittra found a regimen of oral potassium and glucose and subcutaneous insulin to be of value in the treatment of AMI. The death rate of 11.7 per cent in the treated group was significantly below that of 28.2 per cent in the control group.[75] However, a controlled trial of intravenous glucose, potassium and insulin in AMI failed to confirm these benefits. Pentecost, Mayne and Lamb found mortality and the incidence of arrhythmias to be similar among control cases (16 per cent) and treated cases (15 per cent).[76]

Prolonged bed rest, the standard form of treatment for AMI for the greater part of the first half of the 20th century, was reduced in duration from a month or more to only two[77] to three weeks[78] after studies published in the 1950s indicated no ill-effects attendant upon earlier ambulation. Coronary care units are a controversial innovation whose advantages are not yet conclusively proven.

CONCLUSION

The establishment in the Australian hospital sector of coronary intensive care facilities illustrates the quick introduction and predictable imitative adoption of an innovation, the benefits of which randomized trials have so far failed to confirm. Rising health care costs now preclude the wastage of resources[79] exemplified by the successive implementation and supercession of novel approaches to reducing the mortality from ischaemic heart disease. National registers of medical technologies from their inception would facilitate surveillance of trends in the use of innovations. Analysis of forseeable, or first-order costs and benefits, and of unanticipated, or second and third-order consequences, prior to widespread application of a medical innovation, could avoid the indiscriminate adoption of each new technology. Where assessment of technological crisis medicine indicates that gains may be marginal in proportion to costs, or applicable to only a small section of the patient population, alternatives in health care (basic curative research, preventive programmes) warrant consideration.

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