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Abstract

Health policy reforms in New Zealand during the 1990s impacted on hospital operations, on the nursing workforce, and on patients. This study analyses changes in rates of 20 adverse patient outcomes that are potentially sensitive to nursing (OPSNs) before (1989–1993), during (1993–2000), and after (2000–2006) the policy reforms, using all New Zealand public hospital inpatient discharge data for this period. Comparisons of changes in mean annual rates across periods revealed the expected trajectory of acceleration during the reform period relative to the prereform period, and a subsequent deceleration in the postreform period. This S-shaped pattern was clearly evident in 16 of the 20 OPSNs, and partially evident in the remaining 4. These results are interpreted as evidence that the 1990s policy reforms inspired by managerialism had deleterious effects on patient outcomes, and that these effects coincided with changes in nursing resources and the work environment.

Keywords

nursing staffing, patient outcomes, health policy, New Zealand

Introduction

New Zealand has been recognized for her aggressive economic policy changes in the 1980s and 1990s (Gauld, 2000). One commentator called the policy approach *blitzkrieg*—a series of lightning strikes (Easton, 1994). Health reform was only one of many policy changes aimed at reducing New Zealand's trade and budget deficit through privatization of state-owned enterprises and other reforms (Blakely, Tobias, & Atkinson, 2008; Hornblow, 1997; Howden-Chapman & Ashton, 2000; Traynor, 1999). New Zealand's health care reforms included the introduction of market-oriented policies that attempted to separate the government's roles as purchaser and provider and managerialism—the notion that any manager from any industry can manage anything, including hospitals and their services, and that good management strategies could produce efficiencies in service delivery (Boston, Martin, Pallot, & Walsh, 1996). Traditional internal hospital clinical leadership structures were dismantled.

The health reforms affected hospital operations, especially nursing. Nurse managers at the nursing ward level and above were eliminated in favor of generic managers who were selected from any industry (Buchan & North, 2008), and discipline-specific budgets were centralized. There was a lack of nursing involvement in the health reforms that brought about the reorganization in nursing management, a loss of senior nurses

with essential experience and practice wisdom, the rise of recruitment and retention issues, an increase in the casualization of the nursing workforce and decreases in skill mix, and in the quality and availability of professional nursing education (Gower, Finlayson, & Turnbull, 2003). The nursing community curtailed the training and employment of enrolled nurses (ENs, equivalent to Licensed Practical/Vocational Nurses in the U.S.) during the same period, responding to employers' concerns that ENs were too costly for personnel who had to work under supervision (Dickson, 1994). Length of stay was also targeted for reduction.

McCloskey and Diers (2005) reported the effects of New Zealand's health reforms on both nurses and patients from 1989 to 2000. Total nursing hours per 1,000 patient days for medical/surgical patients decreased 9% over the period, with a 36% decrease in combined registered nurse (RN) and EN FTEs (full-time equivalent); although there was an 18% increase in skill mix (%RN). There were significant increases

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in negative patient outcomes that have been previously defined as sensitive to nursing (OPSNs): central nervous system (CNS) complications, decubitus ulcers, sepsis, urinary tract infections (UTI), physiological and metabolic derangement, pulmonary failure, and surgical wound infections. The increase in negative outcomes ranged from 9% for deep vein thrombosis/pulmonary embolus (DVT/PE) to 1766% for CNS complications in surgical patients over the whole period. During this time length of stay dropped by 25% for medical patients and 18% for surgical patients (McCloskey & Diers, 2005).

The present study extends and refines the 2005 study in a number of ways in order to provide a more rigorous examination of the possible links between policy changes and adverse patient outcomes. Whereas the earlier study analyzed changes in outcome rates for the period 1989-2000 as a whole, the present analyses compare rates across the three periods before (1989-1993), during (1993-2000), and after (2000-2006) the reforms. Thus, in broad terms, these analyses have the form of an interrupted time series. A further refinement was the use of rates with denominators that adjusted for length of stay and that were more tightly tied to the specific populations at risk. Finally, whereas the 2005 study used linear autoregression analysis, the present study focuses on changes in mean annual rates across the time periods. This choice was partly dictated by the shortness of the time series within periods, but also avoided the complex assumptions required by regression analysis. As our broad expectation was that the policy changes in the 1990s adversely affected those patient outcomes that are especially sensitive to nursing care, we expected to find that OPSN rates accelerated in the reform period relative to the prereform period, and that they then decelerated in the postreform period.

Setting: The Policy Problem

New Zealand is a country with two major islands and several small ones in the South Pacific with roughly the same land mass as Colorado, and with a population of 4 million. It is a new country, geologically, and politically. The first Polynesian explorers (the antecedents of the contemporary Maori people) came in the 1300s; the first European settlers came in the late 1700s. A formal Treaty (Treaty of Waitangi) between the Europeans and the Maori (indigenous peoples) was signed in 1840 and enforced mostly in the breach. New Zealand was the first country to have a fully publicly funded health care system (Gauld, 2000). It was also the first country to have a Chief Nurse position (Hughes, 2002).

The health system reforms were proposed in 1991 with the publication of a "Green and White Paper" by the Minister of Health, Simon Upton (Upton, 1991). A green paper is usually a proposal lofted for public discussion; a white paper is the government's response. That both policy vehicles were employed signaled the government's interest in immediate

solutions. Before the reforms of the 1990s, there had been 14 area health boards which acted as both purchasers and providers for geographically determined patient populations. When implemented in 1993, the health care purchaser/provider system was restructured into four regional health authorities (the purchaser), while 23 crown health enterprises (CHEs) were established as providers. In 1997, the four regional health authorities were collapsed into one health funding agency (HFA) and 21 hospital and health services were created as the repository for population-based funding for the public hospital (most DHBs had only one) and related public health care agencies. While it has been argued that these reforms were not "to market and back" and in terms of economics, nothing much changed (Fougere, 2001), the continual restructuring coupled with the change to generic management created chaos in hospital operations (Ashton, Mays, & Devlin, 2005).

The State Sector Act (1988) effectively dismantled a somewhat incomplete but none-the-less, national health service and deliberately replaced it with a fragmented service model where multiple, corporatized entities competed with each other on price with no required regard for service quality or patient outcomes. In an unintended and unforeseen consequence of this environment, the professional practice environment for nursing deteriorated very rapidly and the ability of nurses to defend both the quality of care and the quality of the practice environment was severely hampered by the structural separation of senior nurses from those in direct patient care (and this often became a professional separation also and by the legal restrictions placed on nurses' ability to organize a national collective industrial response under the Employments Contract Act 1991).

The reforms were not designed specifically to decrease nursing staffing. Generic managers' charge was to increase efficiency (*vis-à-vis*, save money). Naturally, the largest single proportion of the hospital unit budgets was nursing. Most nursing management/leadership positions from charge nurse up were eliminated or replaced by generic managers with larger spans of control. The changes occurred very rapidly and many nurses in such roles had their positions terminated almost overnight. There was increased substitution of RNs by unregulated caregivers to an extent neither systematically recorded nor formally assessed. As nursing positions turned over, they were eliminated or replaced by new graduate nurses. Supplies and equipment were also targeted with nursing units often left with one sphygmomanometer and inadequate linen. Workloads increased and deprived of disciplinary leadership, nurses began to leave hospitals in New Zealand, often for Australia.

Possibly as a result of these policy changes and the resulting loss of leadership there exists almost no contemporaneous account by nurses and only occasional retrospective studies (White, 2004) have tried to recapture the period. The lack of discipline leadership at ward level and the low morale in the

practice environment were ubiquitous (Finlayson & Gower, 2002; Gower et al., 2003; North & Buchan, 2009).

Following the change to a labor-led Government in 1999, policy change supported a return to increased clinical leadership in hospitals, greater community involvement, and removal of the requirement for hospitals to be profit oriented (Coney, 1996). In many DHBs, a slow return to the establishment of nursing leadership began and there was renewed discourse about the need for professional development of nurses; increasing skill mix and retention and recruitment became key issues (Carryer, 2001).

Neither large-scale savings nor improvements in quality of care were achieved by the health policy changes in New Zealand (Finlayson & Gower, 2002). Nearly all hospitals still have no assigned nursing budget to be administered by the director of nursing. No existing evidence was used to guide policy or management decision making and the effects of resulting staffing models were never estimated. In addition, the increased demand on nursing personnel associated with shorter lengths of hospital stay was not actively acknowledged until much later (Stone et al., 2003).

Review of Literature

The health reforms in New Zealand can be likened to “reengineering” that occurred in the United States during the 1990s (Aiken, Clarke, & Sloane, 2000; Clifford, 1998; Leatt, Baker, Halverson, & Aird, 1997; Urden & Walston, 2001) except that New Zealand’s reforms were by acts of government and affected the entire country. Only one study has been examined the effects of New Zealand’s reforms on operational considerations of nursing resources and patient outcomes in a policy context (McCloskey & Diers, 2005).

That study, and the present one, were grounded in the increasing body of literature dealing with the relationship between nursing resources, the work environment, and patient outcomes, beginning with Aiken’s important policy study using U.S. Medicare data (Aiken, Smith, & Lake, 1994). That study showed that Magnet hospitals (known as “good places for nurses to work”) had higher proportions of RN staffing which were associated with lower mortality in Medicare patients. In the decade following Aiken’s breakthrough study, government reports (Hickam et al., 2003; Seago, 2001; Wunderlich, Sloan, & Davis, 1996) and recent systematic reviews and meta-analyses have built a body of literature linking nursing resources to patient outcomes (Dall, Chen, Seifert, Maddox, & Hogan, 2009; Kane, Shamiliyan, Mueller, Duvall, & Wilt, 2007; Needleman, Kurtzman, & Kizer, 2007; Sales et al., 2008; Unruh, 2008). In general, relationships between increased nursing resources as staffing and skill mix and positive patient outcomes are stronger in ward level studies than studies at the institution, state, or country level, stronger in surgical settings than in medical ones, and stronger in acute care than in nonacute care.

Most of the research on nursing resources and patient outcomes is cross-sectional, generally using 1 year of administrative data. It is becoming increasingly clear that the pathway between nursing resources and patient outcomes leads through aspects of the working environment (Aiken, Clarke, Sloane, Lake, & Cheney, 2008; Clarke, 2007; Duffield et al., 2007; Kane et al., 2007). There have been no related large studies that have had access to data showing outcomes from a policy change that affected a whole country. New Zealand’s health policy changes unwittingly affected hospital operations through the altered deployment of nursing services. This places this present study beyond the “end of the beginning” as described by Clarke (2007, p. 1126) in this trail of inquiry.

Method

Data Sources

New Zealand has one of the finest public data management systems in the world in the NZHIS (<http://www.nzhis.govt.nz/>). The National Minimum Data Set (NMDS) is the complete population of public hospital inpatient discharges (and outpatient visits not analyzed here). New Zealand has used ICD-10 and Australian Refined DRGs (AR-DRGs), which are severely adjusted since 1999. NZHIS manages the NMDS built from electronic feeds from public hospitals (and other agencies). Private hospitals data are excluded as they do not submit their data to NZHIS. In New Zealand private hospital, bed availability is minor in comparison to that of public hospitals.

In addition to the NMDS, NZHIS also manage (but do not collect) the Nursing Workforce Data (NWD). NWD is built from questionnaires sent annually to all nurses certified by the Nursing Council of New Zealand. The questionnaire that accompanies the required certificate renewal collects data about employment status, job title, practice site, and worked hours per week.

After ethical approval, NZHIS provided patient data for all hospital discharges from the fiscal year 1989 through 2006 from the NMDS. Data contained all coded ICD and DRG information (diagnoses, procedures), demographic data (age, gender, and ethnicity) and operational data (admit source, discharge disposition including death). The sample of patient records was >12 million.

Nursing workforce data came from the Nursing Workforce Data Set. The nurse sample was all medical and surgical RNs and ENs providing direct care in public hospitals ($n = 208,760$ total NWD records). An FTE was defined as 33 or more hours worked per week. The workforce was on average 90% RN and 10% EN, with a declining proportion of EN. The study defined medical/surgical nurses as the sum of nurses reporting ICU, Medical/Surgical, or Combination “nurse type” categories on the Nurse Workforce Survey. Data after 1996 were electronic and public hospital medical/surgical

nurses and their hours worked were easily identified. For years 1990-1995, only hard copy aggregate data were available on numbers of public hospital nurses, and hours worked were reported in 8-hr categories (e.g., 1-8, 9-16). The end point of categories was used in estimates, potentially overestimating nursing hours. Estimates of public hospital medical/surgical nurses and corresponding hours worked for years 1990-1995 were modeled on years 1996-2005 actual numbers of medical/surgical nurses and hours worked and validated by application back to reported hours actually worked in the later years. To compensate for the decrease in LOS (from 7 to 5.3 on average over the study period), we converted the number of nursing hours available into nursing hours per patient day so that they could be compared across the years of the study period.

Patient Outcomes

Needleman, Buerhaus, Mattke, Mattke, Stewart, and Zelevinsky (2002) and Mattke, Needleman, Buerhaus, Stewart, and Zelevinsky (2004) identified outcomes potentially sensitive to nursing (OPSN). Eleven OPSN were defined using ICD-9 diagnosis codes and other information in administrative data specific to medical/surgical discharges. Cases in major diagnostic categories (MDC) for maternal, newborn, and psychiatric conditions were excluded as were all cases under 18 years of age.

The inclusion and exclusion rules were crafted to eliminate cases where the instant event might have been present on admission, or where a particular population might have been especially vulnerable to the event. For example, the definition for decubitus excludes all cases with skin disease codes and all cases of para- or quadriplegia as a secondary diagnosis. Thus the OPSN definitions are conservative estimates, and are by definition risk-adjusted cohorts. McCloskey translated the US ICD-9 codes into ICD-10 and the U.S. DRGs into AR DRGs for analysis of New Zealand data (McCloskey & Diers, 2005).

The OPSN included: urinary tract infection (UTI); decubitus; hospital-acquired pneumonia; deep vein thrombosis/pulmonary embolism (DVT/PE); ulcer/gastrointestinal tract bleeding (UGI bleed); central nervous system complications (e.g., syncope, confusion-CNS); sepsis; shock/cardiac arrest; surgical wound infection; pulmonary failure; physiological/metabolic derangement (e.g., hypovolemia). Data were analyzed as rates per 1000 medical or surgical patient days with the numerator and denominator defined by inclusion and exclusion rules as above. The use of patient days rather than number of discharges controlled for patients' length of stay, which is known to have declined during the study period. Subjecting the denominator as well as the numerator to the inclusion and exclusion criteria for a given OPSN ensured that the population was actually at risk of that OPSN. Because there are several versions of Australian DRGs over the 18-year

period, all DRG data were translated by NZHIS to AN (Australian National) DRG Version 3.1 to provide a consistent case mix platform.

Statistical Strategy

All analyses were conducted with Version 17 of the Statistical Package for the Social Sciences. As the data were derived from populations rather than samples, there was no legitimate basis for statistical inference and thus the analyses were descriptive and did not include hypothesis-testing or estimation (Freedman & Berk, 2010). It is also for this reason that we refer to expectations about patterns in the data rather than to statistical hypotheses. Interrupted time series designs are commonly analyzed using time series and regression techniques, but this was precluded for the present data by the shortness of the time series in total and especially within the three policy periods (McDowall, McCleary, Meidinger, & Hay, 1980). Instead, the trend for an OPSN within a time period was simply quantified as the *mean annual change* across adjacent years for that period. These mean changes for each OPSN were then compared across time periods in ordinal fashion. Accordingly, our interest was in whether the mean annual change was greater during the policy change period than in the prechange period, and smaller in the post-change period than in the change period.

Results

Figure 1 shows the pattern of changes in nursing hours across the period of interest. There was a dramatic decrease of nursing hours/patient days after the policy changes were announced, but before the implementation of managerialism. We cannot be sure why this might be but perhaps those who were free to move on without family or other economic ties did so at that point. The period of implementation shows an irregular pattern, which might reflect managerial and nursing responses to the ever-changing contracting and structural policy changes. Nurses were not always sure what was happening but will endure a good deal of unpleasantness in the working environment if they have family to support or other reasons that tie them to the employment situation. In this period in New Zealand, jobs in all public sectors were also difficult to find. Nursing hours decreased to a nadir in 2002, 21.2% lower than the beginning of the time series. The steady increase in nursing hours after 2002 brought them back to approximately what they had been before the policy changes but the demands of the practice environment had concurrently increased through shorter stay and higher acuity.

Figures 2, 3, and 4 show the annual rates for the 20 OPSNs during the prereform, reform, and postreform periods. As the rates vary considerably across OPSNs, and to enhance legibility, the patient outcomes are shown in three separate subgroups—high, medium, and low incidence—in Figures 2, 3, and 4,

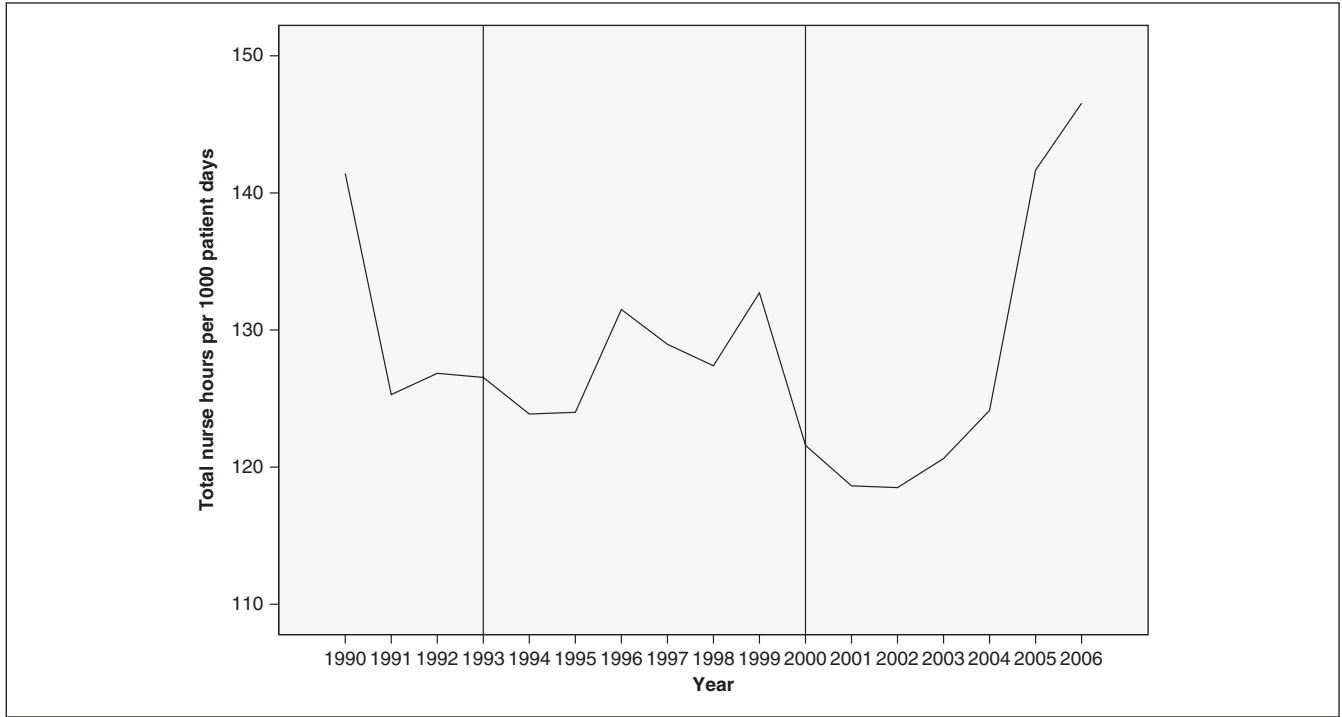


Figure 1. Total medical/surgical nurse hours per 1,000 patient days for 1990-2006

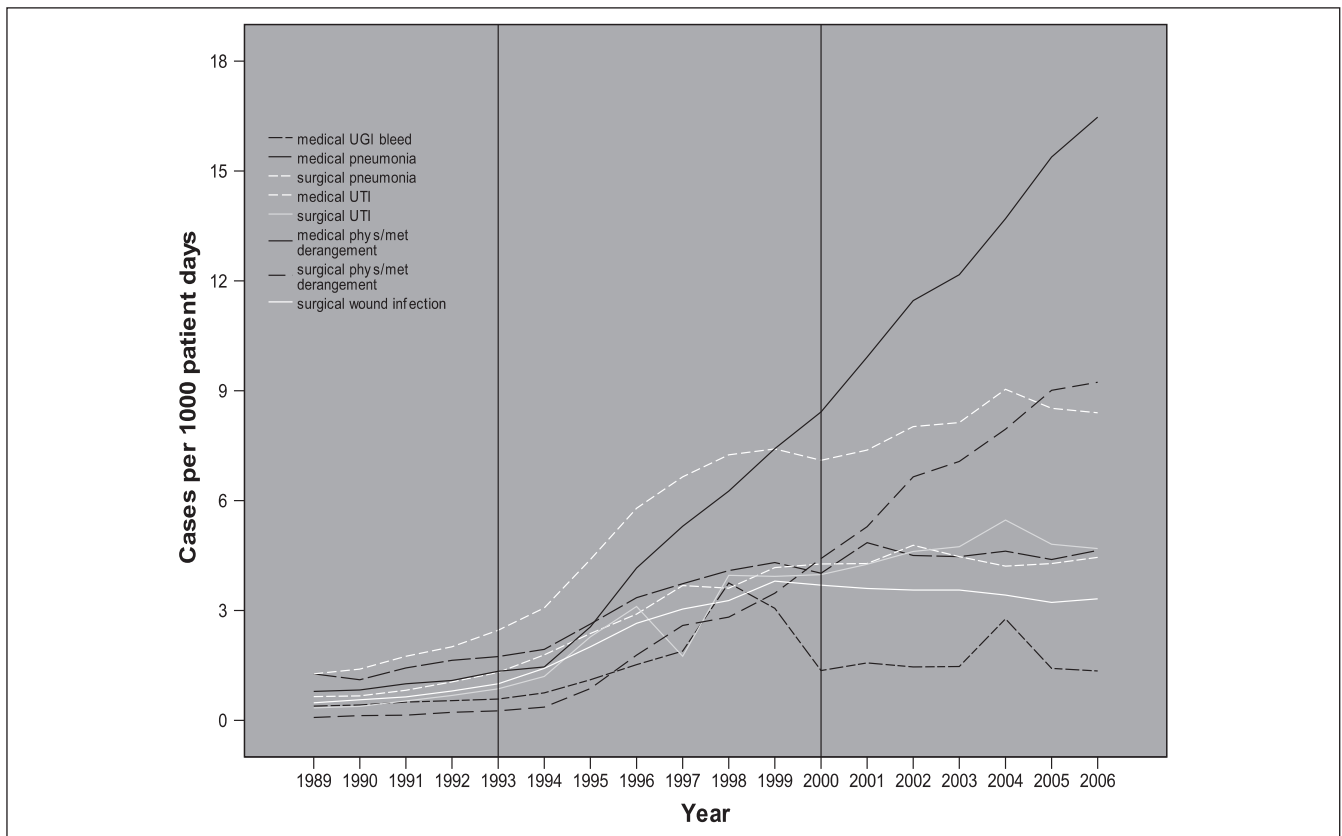


Figure 2. Number of cases per 1,000 patient days for high incidence patient outcomes, 1989-2006

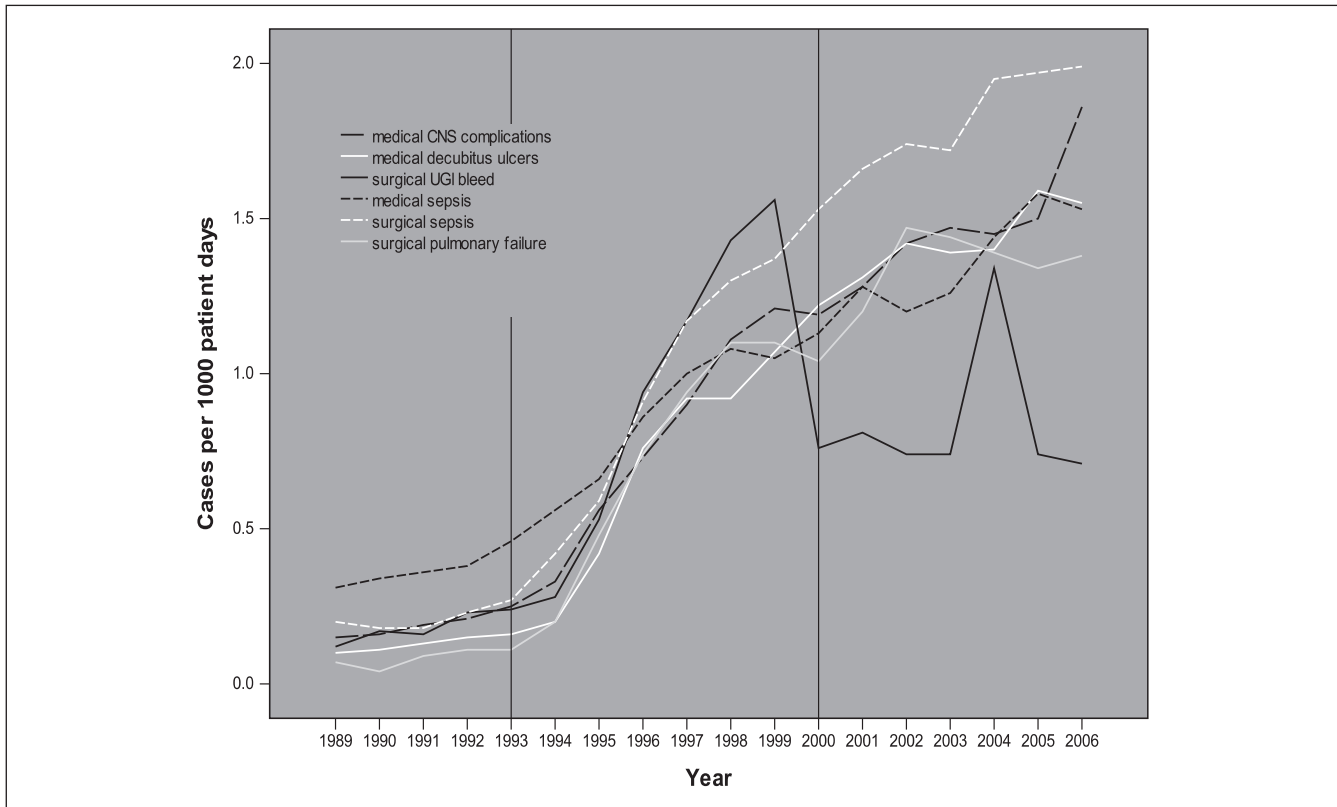


Figure 3. Number of cases per 1,000 patient days for medium incidence patient outcomes, 1989-2006

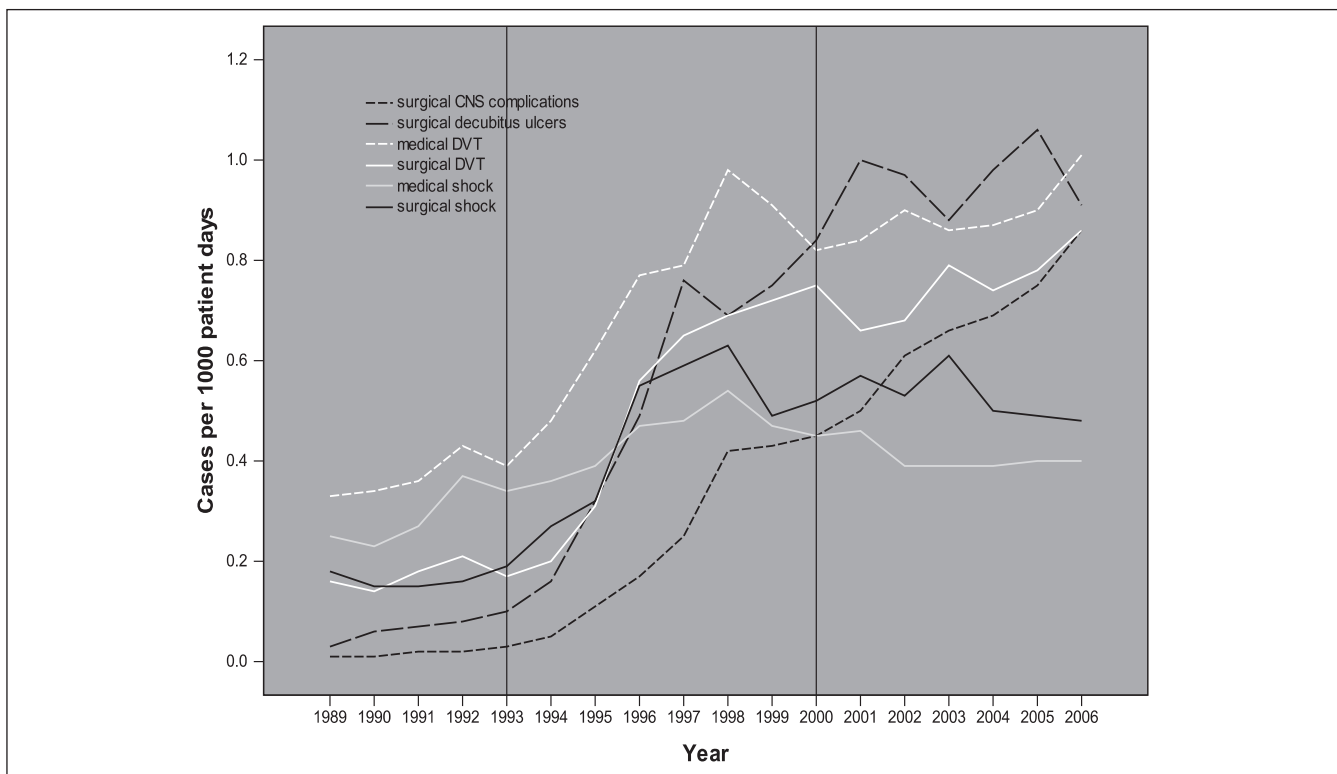


Figure 4. Number of cases per 1,000 patient days for low incidence patient outcomes, 1989-2006

Table 1. Mean Annual Change and Standard Deviations for 20 Patient Outcome Rates Before, During, and After Policy Changes

Patient outcome	Before (Phase 1) 1989-1993			During (Phase 2) 1993-2000			After (Phase 3) 2000-2006	
	Mean change	SD		Mean change	SD		Mean change	SD
Medical CNS complications	0.025	0.013	→	0.134	0.087	→	0.112	0.133
Surgical CNS complications	0.005	0.006	→	0.060	0.056	→	0.068	0.034
Medical decubitus ulcers	0.015	0.006	→	0.151	0.112	→	0.056	0.090
Surgical decubitus ulcers	0.018	0.100	→	0.106	0.108	→	0.012	0.121
Medical DVT/PE	0.015	0.045	→	0.061	0.111	→	0.032	0.050
Surgical DVT/PE	0.003	0.039	→	0.083	0.081	→	0.018	0.076
Medical UGI bleed	0.048	0.022	→	0.111	1.10	→	-0.002	0.845
Surgical UGI bleed	0.030	0.037	→	0.074	0.402	→	-0.008	0.382
Medical pneumonia	0.118	0.206	→	0.326	0.341	→	0.103	0.421
Surgical pneumonia	0.165	0.107	→	0.423	0.298	→	0.030	0.300
Medical sepsis	0.038	0.029	→	0.096	0.070	→	0.067	0.110
Surgical sepsis	0.018	0.033	→	0.180	0.084	→	0.077	0.092
Medical shock	0.023	0.060	→	0.016	0.050	→	-0.008	0.031
Surgical shock	0.003	0.025	→	0.047	0.108	→	-0.007	0.067
Medical UTI	0.298	0.136	→	0.663	0.608	→	0.217	0.516
Surgical UTI	0.130	0.062	→	0.446	1.10	→	0.119	0.473
Medical phys/met derangement	0.138	0.092	→	1.011	0.447	→	10.342	0.368
Surgical phys/met derangement	0.045	0.029	→	0.594	0.332	→	0.802	0.418
Surgical pulmonary failure	0.010	0.034	→	0.133	0.129	→	0.057	0.132
Surgical wound infections	0.130	0.060	→	0.384	0.258	→	-0.062	0.106

Note: → denotes change between phases is in expected direction.

respectively. Although this grouping enhances legibility, the changing scale on the vertical axis means that care is needed in interpreting the amount of change, especially in the medium and low incidence outcomes.

The trends in many of the OPSN rates appear to follow the expected pattern of acceleration in the reform period relative to the prereform period, followed by a deceleration in the postreform period. However, since spotting patterns in graphs are notoriously hazardous, especially when the patterns are expected, the trends have been quantified in Table 1 to provide a less subjective view.

Table 1 shows the amount of change during each reform period for each OPSN. The amount of change is indexed by the mean difference in rates between adjacent years within a given time period. The standard deviation around each mean is also shown to indicate variability of change. Thus a positive mean indicates a rising trend on average, while a negative mean indicates a falling trend. As our focus is on differences across time periods rather than between OPSNs, the table should be read horizontally. Our specific expectation was that the mean change in the reform period would be greater than in the prereform period, and that in the postreform period would be less than that in the reform period. The columns of asterisks in the Table indicate where this pattern is present. As noted earlier, this simple approach was preferred to fitting regression lines and using inferential statistics in

order to acknowledge the shortness of the time series and the use of population rather than sample data.

The asterisks in Table 1 have a notable consistency with 16 OPSNs displaying the broadly S-shaped pattern, and the remaining four showing one of the two expected changes in trend. Within these four exceptions, surgical CNS complications and especially physiological/metabolic derangement rates show a striking tendency to continue accelerating in the postreform period. In contrast, medical shock rates actually slowed during the reform period relative to the prereform period. Although the predominant pattern is consistent and predicted, several caveats need to be raised to guard against over-interpretation. First, while the way in which the rates were calculated helped to adjust for two potential confounds (changes in length of stay and in the population at risk), the rates are hard to interpret in terms of how much change occurred in terms of case numbers. So, while changes are apparent within and across time periods, the *size* of any policy change impact on adverse patient outcomes is not shown in a transparent way in the present analyses.

The second caveat concerns the variability around the mean changes in annual rates. As the standard deviations in Table 1 show, and as is evident in Figures 2 through 4, this was considerably relative to the mean changes. So it should be borne in mind that the means are a relatively crude summary of change patterns within periods. Finally, it is important to note that the

differing number of years within each time period. The reform and postreform period means are based on seven and six data points respectively, whereas those for the prereform period are based on only four data points. Accordingly the trends in the prereform period should be treated with more caution.

These caveats are all noteworthy, and may suggest that the consistency of the S-shaped pattern is overstated in these results. We believe though that the pattern is still sufficiently striking to bear some interpretative weight.

Discussion

The most striking features of the results are the predicted S-shaped trends that emerged, and the consistency of this pattern across 16 of the 20 OPSNs. An uncritical interpretation of these two features would suggest that the analyses demonstrate that the health policy changes in the 1990s increased the rate of adverse patient outcomes and that, when the policies were abandoned, the rates duly decelerated. Furthermore, it could be argued that since the policy changes had deleterious effects on the nursing workforce and environment, and since the patient outcomes were chosen because they are particularly sensitive to nursing interventions, the effects of the policy changes on patient outcomes coincided with changes in the nursing workforce. Further again, the consistency of the S-shaped pattern across OPSNs could be seen as what would be expected if nursing had a relatively undifferentiated effect on these patient outcomes. That is to say, if the effects of the type of changes that occurred in nursing were not condition-specific within this set of OPSNs. This all paints a coherent and credible picture, but what alternative interpretations of the results might be offered?

Before considering specific issues, it is important to emphasize that the most credible alternative explanations would be those that accounted simultaneously for the two features highlighted above—the S-shaped trend and the consistency across OPSNs. It seems reasonable to suggest that the consistency of the pattern could be due to some methodological artifact or confound that was having a nonspecific effect across OPSNs. However, this still leaves the question of whether such an effect could explain the nonlinear shape of the trend, especially the deceleration in the postreform period. In considering alternative explanations we have been struck by how many possibilities, though not all, seem to work for the consistency feature but not for the nonlinearity of the OPSN trends.

Several possibilities arise in the context of measuring of OPSN rates. Calculating the annual number of cases for a given OPSN depended on obtaining diagnoses for all conditions suffered by patients while they were in hospital. During the study period it was clear that the number of diagnoses recorded for each patient in the NZHIS database has tended to increase over time. As noted earlier, it was for this reason

that we standardized the maximum number of diagnoses used to calculate OPSN rates to 19. Inspection of the NZHIS records showed that the number of diagnoses recorded in the early part of the study period was notably less than 19, and the number in the latter part was greater than 19. So, while the use of up to 19 diagnoses was a sensible compromise to control for this changing variable, it leaves the possibility that the S-shaped trends were in part due to changes in the number of diagnoses available in the records and to the decision to use not more than 19 in calculating OPSN rates. Perhaps the increasing rates in the reform period reflected the recording of more diagnoses, and the deceleration in the postreform period, reflected the decision to truncate the number of diagnoses to 19 and thereby underestimate their actual frequency. The amount of analysis that would be required to examine the changing pattern of diagnoses and to relate this to specific OPSNs would be daunting, and it is an exercise we have not been able to undertake. In the absence of this type of analysis it is important to note that in the earlier study by McCloskey and Diers (2005), of which the present one is an extension, they reported a linear rise in OPSN rates during the reform period despite using a maximum of only three diagnoses as a basis for defining cases. So it seems that the relationship between the number of diagnoses used in OPSN calculations and the resultant rates is not as straightforward as intuition might suggest.

Other possible factors that might in principle have affected the trends in OPSN rates concern changes in the populations at risk. One possibility is that the size of the populations at risk changed over time. However, this was countered by defining the population at risk, and therefore the rate denominator, in year-specific and OPSN-specific terms. Another possibility was that patients' length of stay changed over time, thereby altering their length of exposure to potential OPSNs. Inspection of the NZHIS database indeed showed a notable decline over the study period. This potential confound was again countered via the rate denominator by using the number of patient days rather than the number of discharges. It is also noteworthy that the decline in length of stay tended to be linear as opposed to the nonlinearity in the OPSN trends. A third possibility was that the case mix changed over time that is, patients varied systematically in the severity of their conditions. We explored this possibility using the cost weight index available in the NZHIS database and found that the index was remarkably stable throughout the study period.

As is common in any observational study, there are many unmeasured variables that might have acted as confounds. These include changing attributes of the populations at risk, such as age, and institutional processes concurrent with the health policy reforms that might have influenced patient outcomes. However, as noted earlier, we are struck by the difficulty of finding confounds that follow the time trend seen in the results. For example, an ageing population may have

contributed to the increasing OPSN rates in the reform period, but it does not account for the subsequent deceleration in rates. It is clear that using such highly aggregated administrative data to examine complex causal hypotheses about the impact of policy changes on nursing and patient experiences is a hazardous undertaking. However, we believe that a cautious reading of the present analyses, both justifies them and provides further empirical evidence for the complex effects of radical reforms in the health arena.

The pattern of nursing resources does not exactly parallel the policy trends. Changes in nursing resources however involve a number of possible alterations over and above a simple head count or hours available. While skill mix (the proportion of RNs to ENs) increased, changes occurred in the deployment of nursing. White (2004) calls this the “commodification of caring” referring to the process whereby nursing resources were viewed as costs rather than assets, and manipulated to cover demand as cost effectively as possible without attention to the working environment, leadership or appropriate education, and experience and certainly without recourse to any evidence about safety. Casualization of the nursing workforce was an especially pernicious change with an up to 40% change to casual employment reported (Blake, 1997). Nursing resources as a head count bottomed out early in the third period, just when the sharp increases in negative patient outcomes begin. In the period of policy stabilization, nursing hours were gradually restored but we argue that all important operational working environment had changed little. Nursing budgets remained centralized and nursing leadership was confined to professional leadership or advice and did not involve management of, or contribution to operations. Nursing workload improved with the addition of nursing resources and, eventually, adequate supplies and equipments. Yet there was a loss of generation of nursing leadership, the results of which are still being felt (Carryer, 2001; Gower et al., 2003) and a pervasive legacy of mistrust has been created.

Findings show that despite an eventual degree of restoration of nursing resources in the third-policy period, the adverse outcome rates did not generally fall proportionately. It is possible that there is a lag effect between policy change, implementation, and effect. More probably, the policy changes were associated with unmeasured changes in the working environment. Thus, the relationship between nursing resources and patient outcomes is not linear but may flow through qualities of what it is like to try to practice in hospitals going through not only economic but also operational change. Such work may be complicated by changes in patient populations not captured well by the case mix index (which is an index of costs, not severity of illness).

The previous study had found increases in adverse events but decreases in in-hospital mortality. This was attributed to lower LOS (patients may have died after discharge), or to

work prioritization in the face of declining resources (nurses concentrated on life-saving), or technological innovations (McCloskey & Diers, 2005). The present study supports these possible explanations.

Limitations

Administrative data on patient discharges are always limited by accuracy of documentation in the original medical record and then its translation to ICD coding. Definitions of nursing hours had to be estimated for some years. Estimates of nursing resources are potentially overestimates. The OPSN inclusion and exclusion rules produce conservative estimates of actual adverse event rates. Both of these limitations would work against the expectations. No data were available about physician practice patterns, which might have influenced OPSNs.

The time series analysis is limited statistically by the small sample of years (18), the years that encompass the three periods required for defining the phases of policy change. The time periods were defined by policy changes, not by what might have been happening “on the ground.” Policy changes tend to happen quickly in a small country like New Zealand but they were not uniformly implemented across all DHB’s simultaneously. The decentralization and competitive focus of the 1990s health reforms destroyed national collaboration (Ashton, Tenbensel, Cumming, & Barnett, 2008).

Conclusion

Health policy decisions have consequences for both providers and patients, not just government budgets. New Zealand makes a fine laboratory for studying these relationships. The Organization for Economic Cooperation and Development (2008) reports New Zealand workforce planning is still noticeably ad hoc and fragmented, suggesting that while the third period in question signaled a move away from a market-oriented approach, it has not been accompanied by focused and centralized workforce planning. For nursing this may be, as Kurtzman (2010) has recently argued, because the nurse-value case has still not been fully made. As Kurtzman notes, “Policy makers must be persuaded by arguments derived from scientific advancements, business insights, social benefit, and political sensibilities” (p. 53).

However, staffing levels are one measure of the quality of nurse services. Leadership, organizational structure and investment in education are similarly important but more nuanced and much harder to measure. Finally, health services research lacks good measures of the quality of the hospital working environment although recent work provides some hints (Roche, Diers, Duffield, & Catling-Paull, 2010). The Magnet Hospital™ process may produce quantifiable measures that can be applied internationally.

New Zealand's health policy reforms may not have changed the economic environment for health care in the country, but they were associated with decrements in hospital operations and increments in adverse patient outcomes. The persistence of negative patient outcomes suggest that the restabilization of policy has not yet resulted in stabilization of hospital operations. Health policy change which neither consider operational nor patient outcomes may have unintended consequences.

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