THE NEW ZEALAND MEDICAL JOURNAL
Journal of the New Zealand Medical Association

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This Issue in the Journal

Interference with the operation of medical devices resulting from the use of radio frequency identification technology
Bryan Houliston, David Parry, Craig S Webster, Alan F Merry

Radio frequency identification (RFID) technology has many potential applications in the hospital environment, and its use in efforts to improve patient safety, reduce waste, and increase efficiency has increased steadily over recent years. A significant obstacle to more widespread use is the potential for electromagnetic radiation from RFID technology to interfere with other electronic medical devices. We have replicated previous research showing that high-power RFID technology can cause important OR equipment to fail completely. But we were unable to produce any interference with the same equipment when using low-power RFID technology, suggesting that it is safe for use in the hospital environment.

Adult total parenteral nutrition at Auckland City Hospital: a 6-year review
Elana Brokenshire, Lindsay D Plank, Lyn K Gillanders, Kerry McIlroy, Bryan R Parry

Total parenteral nutrition (TPN), in which total nutritional requirements are given intravenously provides life-saving nutrition for many patients suffering from serious and complex conditions. Details of all TPN use managed by the Nutrition Support Team at Auckland City Hospital were recorded over a 6-year period during which the same specialist TPN nurse was employed. Length of TPN episodes decreased over the period and use of TPN catheters inserted through a peripheral vein increased to near 50% of all lines inserted. After the first year, the bloodstream infection rate attributable to TPN catheters stabilised at close to 2 per 1000 catheter days and provides a benchmark for the TPN service.

Implementation of a pharmacist medication review clinic for haemodialysis patients
Sanja Mirkov

Pharmacists can be taught and should be encouraged to participate in multidisciplinary teams to assess pharmacotherapy risk to patients on haemodialysis. The major drug-related problem was non-adherence with medication regimens. A number of interventions aimed at improving medication adherence were trialled including provision of medication card alongside verbal and written patient education, simplifying dosages and involving patients as partners in their pharmaceutical care. New Zealand Māori and Pacific Peoples were more likely to have multiple drug-related problems compared to Europeans. Future research should focus on specific educational packages about medicines for New Zealand Māori and Pacific Peoples as these two ethnic groups have been identified at risk of drug-related problems.

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Laparoscopic splenectomy and the treatment outcomes for idiopathic thrombocytopaenic purpura at North Shore Hospital
Shalvin Prasad, Richard Harman, Ross Henderson, Sanjeev Chunnilal, David Simpson

This paper researches the details of 43 patients that had their spleen removed using keyhole surgery at North Shore Hospital from 1998 to 2007. The standard of operation and aftercare by the surgical team is of an internationally acceptable quality. A variety of spleen disorders have been treated with 67% of the cases being idiopathic thrombocytopaenic purpura (or ITP which is a bleeding disorder with low platelet counts) that did not respond to drug treatment. Long-term, in 73% of ITP patients, platelet counts were increased after keyhole spleen surgery. At present, there are no single factors identified that can accurately predict which patients will respond to surgery.

Renal stone disease in Christchurch, New Zealand. Part 1: presentation and epidemiology
Peter J Davidson, Ian G Sheerin, Chris Frampton

Incidence of renal stones in Christchurch 105 per 100,000 population. Two-thirds of stone patients are males. Most people with stones are between 30 and 60 years of age. People with stones were more likely to be from the trades or machine operators. 20% had a family history and 33% had a previous stone.

Renal stone disease in Christchurch, New Zealand. Part 2: a community study on the burden of renal stone disease
Peter J Davidson, Ian G Sheerin, Chris Frampton

This study describes in detail the financial and social burden of kidney stones in the Christchurch community over a 1 year period in 2001–2. The burden of stone disease is considerable and when extrapolated NZ-wide amounts to over 18 million dollars per year. Much of this cost is borne in emergency and inpatient hospital expenses.

Not in my hospital? Ethnic disparities in quality of hospital care in New Zealand: a narrative review of the evidence ((review article))
Juliet Rumball-Smith

There are well-documented differences in health outcomes between Māori and New Zealand Europeans, some of which persist despite adjustment or control for socioeconomic status and demographic variables. The health system is well-accepted as a determinant of health: Is it possible that the services designed to improve health and well-being may be contributing to the ethnic health disparities in New Zealand? This narrative review aimed to study evidence for disparities in the quality of public hospital care for Māori and non-Māori in New Zealand. Eleven studies are assessed in

this article, with each investigation noting a difference in the quality of care for Māori compared with non-Māori. In the majority of these investigations, Māori received the poorer treatment according to current standards or clinical need. This review finds robust evidence for the existence of healthcare disparities for Maori, in particular related to obstetric intervention and the incidence of potentially avoidable adverse events. As health professionals, it is important to take ownership of this evidence, and use it as a possible area for intervention, to work towards improving health outcomes for Māori.

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The increasing role of bioengineering and medical physics in the practice of medicine

Anthony Butler

This issue of the *NZMJ* contains a paper presenting the safe introduction of a medical device into Auckland Hospital.[1] This paper raises the entire issue of medical devices (which are technology integral to modern practice, both patient diagnosis and care) and the importance of practitioners having a broad understanding of technologies to enable them to work with staff who assess and mitigate the risks associated with the new technologies.

The article studies the introduction of RFIDs (radio-frequency identification) for tracking of inventory within an Auckland ICU. The authors demonstrate that under normal circumstances the system is safe and causes no interference with the other equipment within the ICU. However, by exploring extreme circumstances they found non-real world situations where their equipment could fail.

The article is significant for two reasons. Firstly it confirms that the new technology is implemented in a safe way within a New Zealand hospital. Secondly, and more importantly, it highlights the medical professions' increasing dependence on technology and devices, thus raising unfamiliar risks and responsibilities for many medical practitioners.

Dependence on technology extends from diagnosis through to treatment. Our hospitals and care systems rely on technology to track and organise patients, and to disseminate tests and results. Our medical research is also highly dependent on medical physics and bioengineering. Computer modelling and imaging are of growing importance across many disciplines.

A common example is diagnostic radiology. Commonly the image is digital from the time of acquisition, through to its eventual display and radiologist reporting. Digital images and reports are disseminated to the referrer. While there are clear benefits, this digital pathway has introduced some risks that may not be recognised by clinicians. For example, a referrer may have access to a study moments after it was obtained and well before it is seen by a radiologist.

While many benefits flow from this early access, many referrers are not aware of the pitfalls that they may encounter on their remote viewing station. Common pitfalls include incorrect monitor setups or image viewing parameters that can lead to a significant finding being overlooked.

In the interpretation of diagnostic imaging, while the referrer is not expected to be able to understand the nuances of digital image display and image manipulation, there is a requirement for them to have basic computing skills and access to technical support so that they can safely operate the system.

The diagnosis and treatment of some patients can be solely based on medical devices—e.g. obstructive sleep apnoea may be diagnosed by a medical device such as

a pulse-oximeter used during sleep. Treatment is then another medical device, a home CPAP machine. While most practitioners are trained in giving advice on medication safety, few have training to allow sophisticated advice on the optimal use of such devices and any potential hazards that may occur secondary to device malfunction from external factors.

Another area where the roles and responsibility of practitioners is changing, is the increasing use of electronic systems to organise and track patients and their therapies. In a hospital setting this includes ordering of testing and viewing results. In future, computer systems are likely to become the norm for drug charts and patient notes.

Up until now, practitioners have understood the system they use (e.g. paper notes) and are able to identify system errors. As these systems become more complex, practitioners hand over responsibility for design and specification to support staff. Thus an important input into system design and safety is lost. In my radiological practice, 5 years ago we had film packets containing a patient's studies.

If a study was to "fall off" the reporting pile and get lost behind a desk a single patient's study might go missing. Awareness of these problems allowed radiologists to develop departmental systems to prevent problems. However, now an error in the computerised work list could allow thousands of patient exams to remain unreported without being noticed.

Unfortunately with computerised systems, practitioners often retreat from involvement with the system design and specification. This can leave the support staff guessing at the relative importance of features and safety checks when buying or commissioning systems.

For general practitioners implementing electronic record systems, a broad level of understanding is required in appreciating computer security and data archiving requirements so they are able to engage with the computer vendors.

In summary, technology is playing an increasing role in the diagnosis and care of our patients. This trend will continue. Practitioners need to have a broad appreciation of the technology they use. In particular they need to understand the benefits as well as the potential risks that that increased technology brings both at the patient level and at a systems level.

In all of the above examples, including the RFID paper in this issue, having a broad understanding of technology allows practitioners to work closely with groups developing and implementing care systems. This can only be good for the patient..

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Interference with the operation of medical devices resulting from the use of radio frequency identification technology

Bryan Houliston, David Parry, Craig S Webster, Alan F Merry

Abstract

Aim To replicate electromagnetic interference (EMI) with a common drug infusion device resulting from the use of radio frequency identification (RFID) technology in a simulated operating theatre environment.

Method An infusion pump, of a type previously reported as having failed due to RFID EMI, was placed in radio frequency (RF) fields of various strengths, and its operation observed. Different strength RF fields were created by varying the number of RFID readers, the use of a high-gain RFID antenna, the distance between the reader(s) and the infusion pump, and the presence of an RFID tag on the infusion pump.

Results The infusion pump was not affected by low-power RFID readers, even when in direct contact. The pump was disrupted by a high-power reader at 10 cm distance when an RFID tag was attached, and by a combination of high-power and low-power readers at 10 cm distance.

Conclusions Electronic medical devices may fail in the presence of high-power RFID readers, especially if the device is tagged. However, low-power RFID readers appear to be safer.

Recent years have seen a slow but steady increase in the use of RFID systems in hospitals. The two major components of RFID systems—readers and tags—are comparable in function to barcode scanners and labels. An RFID reader transmits an RF signal, which is picked up by any nearby tags. Each tag responds with a signal of its own, which encodes data such as a unique identification number.

The reader picks up each tag's response signal, decodes the data, and passes it on to a suitable information system for processing.[1] This wireless communication gives RFID technology a number of advantages over barcodes, in particular the ability to read multiple tags simultaneously without requiring a direct line-of-sight.

These advantages have seen RFID used in hospitals for applications such as patient and staff identification; 'smart cabinets' for secure storage of drugs and supplies; real-time tracking of beds, wheelchairs, and other equipment; and checking for retained surgical items.[2]

Many types of RFID technology are available to suit the requirements of different applications. Systems that operate within a very small area, such as checking for retained surgical items, typically use handheld, battery-operated, low-power readers, and passive tags, which are powered by the energy in the reader's RF signal.

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Systems that operate over a large area, such as tracking equipment, are more likely to use mains-powered, wall- or ceiling-mounted, high-power readers and/or active tags, which are powered by on-board batteries.

A widely acknowledged risk of deploying RFID technology in the hospital environment is electromagnetic interference (EMI) affecting the operation of other electronic medical devices. Research on other technologies that produce EMI, such as mobile phones and wireless computer networks, have shown that they can cause electronic medical devices to function in unexpected ways, or even to fail.[3–5] However, there has been little published research testing the effect of EMI produced by RFID technology specifically. What has been published has tested RFID systems in non-hospital environments, such as Irnich's experiments with pacemakers and electronic security systems in shops.[6]

Two recent articles,[7,8] testing common types of RFID technology and a wide range of electronic medical devices in realistic hospital settings, are welcome additions to the literature. Both research teams adopted a similar approach: An RFID reader was placed around 2 m away from various electronic medical devices, and then moved closer or further away to determine the maximum range at which EMI affected each device.

Despite this common method, the two teams reported quite disparate findings. Christe et al[7] report that, in 1600 tests of passive RFID technology operating in the ultra-high frequency (UHF) range, they found no interference with any medical device at any distance tested (from 30 cm up to 1.8 m).

Van der Togt et al[8] report that, in 246 tests of passive and active RFID technology operating in the UHF range and the low frequency (LF) range, they found 68 instances of interference with the medical devices. This interference ranged from minor effects (such as unexpected noises coming from computer monitors) to potentially hazardous failures (such as infusion pumps and ventilators stopping), and occurred at distances from 1 cm to 6 m away from the device.

Given the other published research, the results of Christe et al[7] seem surprising. The complete lack of interference found by these authors raises the possibility that some of the results were false negatives, perhaps due to a flaw in the design or execution of the experiments.

Both research teams were using high-power RFID readers, transmitting at their maximum output power of 4 W. Van der Togt et al[8] note this as a limitation of their research, and note its impact on their results: "the number of EMI incidents increased with higher output power of transmitting RFID systems" (pg 2889).

In many developed countries, telecommunications regulators limit the maximum power output of RF transmitters to 4 W in the UHF frequency band. Under New Zealand regulations,[9] 4 W is permitted only for RF transmitters that employ specific measures to reduce EMI, such as frequency-hopping. Otherwise the maximum power level permitted is only 1 W.

Our group is currently using low-power, handheld UHF RFID technology as part of a research project at Auckland City Hospital (ACH) and the University of Auckland's Advanced Clinical Skills Centre (ACSC) on improving patient safety during

anaesthesia.[10] RFID readers are placed at various locations around theatre, including close to infusion pumps, ventilators, and other electronic medical devices.

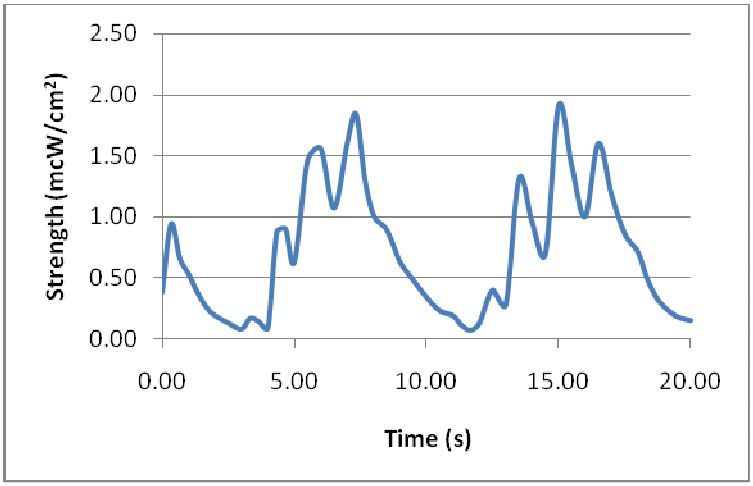
It was therefore considered prudent to replicate one of the serious device failures reported by van der Togt et al,[8] in order to evaluate the EMI risk posed by low-power RFID readers and whether further study was warranted. This paper presents the results.

Method

Of the medical devices tested by van der Togt et al,[8] the Graseby 3500 infusion pump appeared to be one of the most sensitive to EMI, experiencing a serious failure at a distance of up to 1 m. Therefore we decided to test a Graseby 3500 infusion pump in these experiments. The pump tested had been in regular use, without any apparent malfunction.

The research project under way at ACH uses the Tracient Padl-R passive UHF RFID reader. This reader has been designed specifically to produce very low levels of EMI. Note that this paper uses the term 'power' to refer to the power output by an RFID reader. When referring to the 'power' experienced by a medical device at some distance from the reader, the term 'field strength' is used, expressed in mcW/cm^2. As shown in figure 1, the Tracient's field strength at 10 cm peaks at 2 mcW/cm^2.

Figure 1. RF field strength of Tracient RFID reader at 10 cm



It was expected that the Tracient's low field strength would not be sufficient to interfere with the infusion pump. Bearing in mind the results of Christe et al,[7] it was desirable to create interference in at least one test, to provide some confidence that negative results (i.e. no interference) were not false negatives. Thus additional experiments were planned in which the infusion pump would be exposed to stronger RF fields, created by:

- Using multiple RFID readers simultaneously.
- Connecting an antenna to the RFID reader. The Tracient Padl-R reader does not allow for an antenna to be connected, so we used a SkyeTek M9 UHF reader with a broadband antenna. The SkyeTek reader itself has the same maximum power output as the Tracient, about 0.5 W. But the broadband antenna increases the SkyeTek's maximum power output to around 2.2 W. As figure 2 illustrates, this higher power output translates into 25 mcW/cm^2 peak field strength at 10 cm, more than 10 times greater than the Tracient.

Figure 2. RF field strength of SkyeTek reader at 10 cm

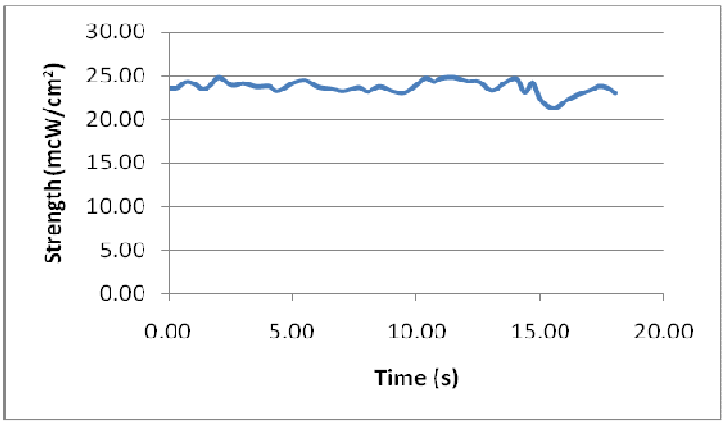


Figure 3. RF field strength of Tracient reader at 10 cm + tag at 0 cm

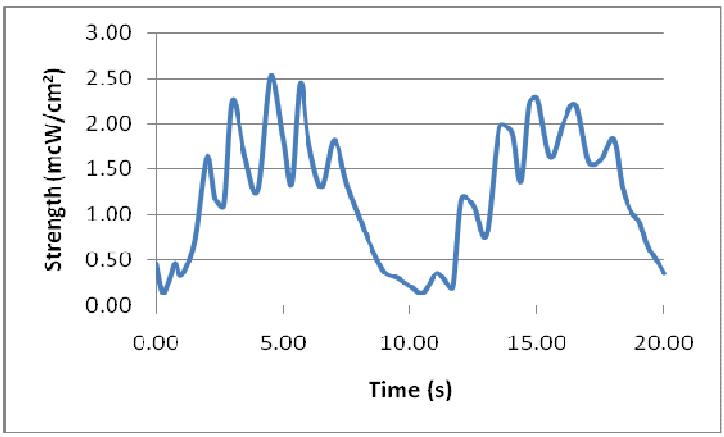
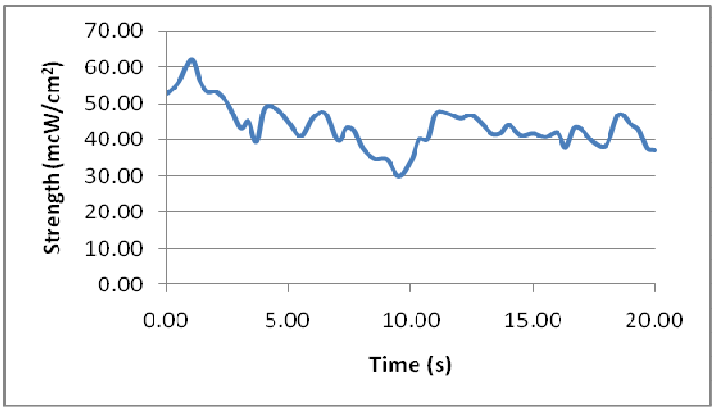


Figure 4. RF field strength of SkyeTek reader at 10 cm + tag at 0 cm



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- Attaching an RFID tag to the infusion pump. When an RFID tag responds to a reader, it briefly becomes an RF transmitter. Figures 3 and 4 illustrate this effect for the Tracient and SkyeTek readers respectively. The peak field strength at 10 cm is increased by around 25% for the Tracient, and more than doubled for the SkyeTek.

The final test plan called for up to 15 tests. The first test replicated those of Christe et al[7] and van der Togt et al.[8] One Tracient reader was placed 1 m away from the pump, in line with the results from van der Togt et al.[8] The reader was then moved closer or further away to find the maximum range at which interference occurred.

If no interference resulted, then additional tests were performed, covering combinations of the following three variables:

- Reader setup. Three additional reader setups were used, producing increasingly stronger RF fields: four Tracient readers placed side-by-side, then the SkyeTek reader, and then all five readers placed side-by-side.
- Distance. Tests started with the reader(s) placed 10 cm away from the pump. If no interference resulted, the reader(s) were placed in direct contact with the pump.
- Presence of an RFID tag. If the reader(s) alone did not interfere with the pump, then a Rafsec G2 UHF RFID tag was placed on the pump.

Each test was performed twice to determine reproducibility.

The tests were performed over two days at the ACSC, in an RF-controlled area. Readings taken before testing showed a background field strength of 0.01 mcW/cm.[2] Tests were conducted on a plastic surface approximately 1 m above the floor and at least 1 m from any conductive surface. In each test the infusion pump was observed for a minimum of three seconds, to determine whether it experienced interference.

Results

Ten tests were conducted. The results are summarised in Table 1. As expected, initial tests using a single Tracient reader did not produce any interference with the infusion pump. The same was true for tests with four Tracient readers. Interference occurred in two tests: using the SkyeTek reader with a tag on the pump, and using all five readers simultaneously.

Table 1. Test results

Reader setup	Distance (cm)	Tag?	Interference?
1 Tracient	100	No	No
1 Tracient	50	No	No
1 Tracient	30	No	No
1 Tracient	20	No	No
1 Tracient	10	No	No
1 Tracient	0	No	No
1 Tracient	10	Yes	No
1 Tracient	0	Yes	No
4 Tracients	10	No	No
4 Tracients	10	Yes	No
4 Tracients	0	No	No
4 Tracients	0	Yes	No
SkyeTek	10	No	No
SkyeTek	10	Yes	Yes
SkyeTek + 4 Tracients	10	No	Yes

In both cases the pump failed completely. It stopped working, sounded an alarm, and displayed the message 'FAULT CODE 10'. The pump could not be reset, and had to be switched off and back on. Each failure occurred on only one execution of the test. In other executions of the same test, the pump functioned normally. However, once the pump had failed the first time, the same failure occurred three times between tests, when no RFID readers were active.

Discussion

EMI from high strength RF fields did appear to interfere with a Graseby 3500 infusion pump, producing a failure similar to that described by van der Togt et al.[8] This provides some confidence that the lack of failures in the other tests were not all false negative results. That the failure could not be reproduced reliably is probably due to the marked fluctuation in the strength of RF fields produced by the RFID readers used, as illustrated in Figures 1–4. Interference is most likely caused only near peak field strength.

'FAULT CODE 10' in the Graseby 3500 indicates a failure in the motor driving the pump. The fault is normally caused by mechanical failure in, or interruption of the power supply to, the motor. It is not clear how EMI could cause such a failure. It seems likely that the interference is not affecting the motor itself, but the pump's control circuitry.

After initial failure, the infusion pump failed subsequently at times when no RFID readers were active. In the controlled test environment it seems unlikely that such failures were caused by EMI from other sources. A more likely explanation is that the process for resetting the infusion pump after the initial failure (i.e. switching it off and then back on) may not have cleared the condition that led to the failure, leaving the pump able to fail again spontaneously. This highlights another possible risk of RFID interference with medical devices, namely the uncertain reliability of a device once it has failed and been reset in the usual way.

It is therefore important that the definitive procedure for resetting each medical device is determined and disseminated to the relevant staff, and we consider this a priority for device manufacturers and theatre technicians.

This research has been subject to the limitations common in EMI testing. The results reflect the properties of the Tracient and SkyeTek readers, notably the variability in RF field strength. The operation of the infusion pump may have been affected by the lack of a recent electrical service check, but it had shown no faults in regular use prior to this research.

The design and execution of the tests may have been improved given better documentation for the infusion pump, particularly on reset procedures. However, switching the pump off and then on again is the method normally thought sufficient to reset such a device. Available time and resources meant that only selected RFID technology and medical devices have been tested to date.

It is, of course, not possible to extrapolate the results for this one device to all the other electronic medical devices common in theatre , such as other infusion pumps, pacemakers, ventilators, fluid warmers, anaesthetic monitors, and diathermy units.

Further testing is planned, but in the meantime our data do provide some degree of reassurance in relation to the safety of low power RFID readers.

The conclusion of van der Togt et al,[8] that the number of EMI incidents increases with higher output power of transmitting RFID systems, is essentially confirmed by our study but can now be refined. All RFID readers in these tests were operating at the same maximum output power, around 0.5 W.

The SkyeTek's broadband antenna allowed it to produce 2.2 W maximum output power, but this still did not interfere with the infusion pump. However, attaching an RFID tag to the pump, increasing the RF field strength experienced by the device but not the reader's output power, caused the pump to fail.

Thus the chance of EMI incidents appears to increase with higher RF field strengths experienced by medical devices, determined by higher output power of the RFID system, shorter distance between the RFID reader and the medical device, and the presence of an RFID tag.

The low-power Tracient readers produced no failures, even when multiple readers were in direct contact with the infusion pump. These readers appear to be safer for use in theatre, and presumably in the wider hospital environment, in the configuration used by our group.

Competing interests: Craig S Webster and Alan F Merry have financial interests in Safer Sleep LLC, a company that provides products to improve patient safety during anaesthesia.

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Adult total parenteral nutrition at Auckland City Hospital: a 6-year review

Elana Brokenshire, Lindsay D Plank, Lyn K Gillanders, Kerry McIlroy, Bryan R Parry

Abstract

Aim To summarise and evaluate data on the use of total parenteral nutrition (TPN) and associated septic complications at Auckland City Hospital (Auckland, New Zealand) over a 6-year period beginning with appointment of a specialist TPN nurse.

Methods For each adult patient requiring TPN on an inpatient basis (excluding those in critical care) between January 1998 and December 2003 demographic data, reason for TPN requirement, number of days of TPN administration, type of central venous line used for administration, and frequency of infectious complications were collected prospectively.

Results 498 episodes of TPN were recorded in 484 patients (202 male, median age 60, range 15–89 y). Median duration of TPN administration was 11 (range 1–326) d. Over the 6-year period the number of episodes of TPN per year did not change significantly while median duration of TPN decreased from 14.5 d in 1998 to 8 d in 2003 ($p<0.0001$). Paralytic ileus following abdominal surgery was the predominant indication for TPN. After 1998, the rate of catheter-related bloodstream infections stabilised at 2 per 1000 TPN days.

Conclusions These results provide a benchmark for infection rates associated with administration of TPN managed by a Nutrition Support Team in a New Zealand tertiary care hospital.

Total parenteral nutrition (TPN), in which total nutritional requirements are provided intravenously, was developed at the University of Pennsylvania School of Medicine 40 years ago and applied clinically to support malnourished surgical patients.[1] Within a relatively short period of time, TPN was shown to be valuable in providing life-saving nutrition for both medical and surgical patients suffering from serious and complex conditions.

Adult TPN at Auckland Hospital, excluding patients in intensive care, is managed by a Nutrition Support Team (NST) consisting of medical, pharmacy, nursing, and nutrition health professionals. Multidisciplinary NSTs improve efficiency, reduce error and waste, and reduce complications for patients receiving TPN, a high risk and costly mode of nutrition support.[2,3]

Data relating to adult TPN use have been collected prospectively since January 1998 when a specialist TPN nurse was appointed. The aim of this report was to summarise and evaluate these data on the use of TPN and associated septic complications for the 6 years to December 2003 in order to provide benchmark information for our service particularly in relation to catheter-related infection rates.

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Methods

Auckland City Hospital is a university-affiliated tertiary care centre. Major surgery including gastrointestinal, neurologic, transplant, and ear, nose, and throat, is performed at this institution. Data were collected prospectively on all adult patients (excluding critical care) requiring TPN on an inpatient basis between January 1998 and December 2003 and entered into a computer database. These data included patient demographics, reasons for TPN requirement, number of days of TPN administration, type of central venous catheter (CVC) used for administration and the type and frequency of infectious complications. Patients on home TPN admitted for any reason were excluded.

The NST reviewed all referrals for TPN and each patient was independently assessed for the most appropriate nutritional support required. General guidelines followed in this assessment include:

- The gut should be used if possible,
- A jejunal tube should be placed if gastric emptying is delayed and, in patients undergoing surgery, such a tube should be placed at time of surgery if deemed appropriate,
- For postoperative patients, TPN should be considered if oral intake has not been established by 5–7 days in a nutritionally depleted patient and 7 – 10 days in a patient previously well nourished.

The CVC used for TPN administration was occasionally placed in the operating theatre at time of surgery or more commonly under sterile conditions in the post-anaesthetic care unit by an anaesthetist.

Since 2000 a nurse-led, peripherally-inserted central catheter (PICC) service has been available based in the Department of Radiology. New venous access for TPN administration was obtained using CVC inserted into internal jugular or subclavian central veins or PICC inserted into brachial or cephalic peripheral veins.

Bone marrow transplant patients received TPN through double lumen tunnelled catheters placed routinely in these patients. Patients on haemodialysis received TPN through the spare lumen of their haemodialysis catheter.

For each patient the primary indication for TPN was recorded. Paralytic ileus was defined as a situation where normal bowel activity had not returned by the fifth postoperative day and there was increasing abdominal distension. Nausea from gastric stasis and vomiting occurs if a nasogastric tube is not placed for decompression and drainage. Small bowel obstruction was defined as mechanical bowel obstruction due to adhesions, oedema and/or sepsis taking longer to resolve than uncomplicated ileus or requiring relaparotomy.

Each patient was visited daily (weekends excluded) by NST members and progress monitored. TPN formulations for each patient were individualised and reviewed daily except for weekends. TPN was generally discontinued when the patient had established an oral intake of approximately 1000 kcal/d. Progress of each patient was reviewed at weekly meetings of the NST. Line-associated complications were monitored.

Insulin therapy by either subcutaneous injection or inclusion in the TPN prescription was considered for patients with serum glucose concentrations of 10 mmol/L or higher. Training of ward nurses in the management and care of CVCs according to established NST protocols was the responsibility of the specialist TPN nurse. Dressings were changed every 7 days, unless an earlier change was indicated, using sterile techniques and transparent dressings.

TPN was discontinued in any patient becoming febrile (>38.5°C) and blood cultures were taken concurrently from their catheter and a peripheral vein as part of a full screen for sepsis. The CVC was left *in situ* until bacterial culture results were available unless the patient continued to deteriorate and no other source of sepsis could be found. If the cultures showed nil growth then TPN was continued through the original CVC. If the blood culture drawn through the CVC returned a positive result the CVC was removed and replaced when the patient had been afebrile for 48 hours. A new CVC was placed after approximately 48 hours of antibiotic treatment with the patient remaining afebrile and TPN recommenced.

A catheter-related bloodstream infection (CR-BSI) of a patient with accompanying clinical symptoms of blood stream infection and no other apparent source of infection was defined as either (1) isolation of the same organism from blood drawn simultaneously from the catheter lumen and from a peripheral

vein, or (2) a >10-fold colony count difference in blood cultures drawn from the catheter and peripheral blood.[4,5]

Duration of TPN was compared between years using the Kruskal-Wallis test. Rates of infection were expressed per 1000 catheter days and compared between years using the *z* test. Indications for TPN and catheter types used were assessed over time using Fisher's exact test. P<0.05 was considered significant.

Results

Over the 6-year period 1998 to 2003, 498 episodes of TPN were recorded in 484 patients (202 males, 282 females, median age 60, range 15–89 y). Median duration of TPN administration was 11 (range 1–326) d. The number of episodes of TPN and number of patients placed on TPN in each year remained essentially constant over the 6 years (Table 1) while median duration of TPN decreased (p<0.0001).

Table 1. Number of total parenteral nutrition (TPN) episodes per year and number of days required

Year	Number of patients	TPN episodes	TPN days		
			Total	Median	Range
1998	94	94	2082	14.5	2–153
1999	67	67	1281	13	3–135
2000	94	96	1468	11	1–70
2001	75	78	1276	10	2–290
2002	72	73	1453	10	1–155
2003	88	90	1412	8	1–326

TPN=total parenteral nutrition.

The primary indications for initiating TPN are detailed in Table 2 for each of the 6 years. These did not change significantly over the 6-year period (p=0.51). Paralytic ileus was the most common indication with 32% of patients receiving TPN for this condition which usually resolved within 1–2 weeks. Median duration of TPN for paralytic ileus was 13 d in 1998 and by 2003 had dropped to 7 d (p=0.06).

Table 2. Indications for total parenteral nutrition

Indication	1998	1999	2000	2001	2002	2003	Total
Paralytic ileus	24	19	30	29	24	31	**157**
Enterocutaneous fistula	14	4	14	8	9	4	**53**
Small bowel obstruction	13	11	13	7	8	8	**60**
Small bowel perforation/anastomotic leak	11	12	13	14	9	15	**74**
Oncology/bone marrow	15	10	8	6	5	12	**56**
Short gut syndrome	2	2	5	3	1	1	**14**
Pancreatitis	7	3	5	3	4	6	**28**
Renal/sclerosing peritonitis	2	0	1	3	2	3	**11**
Inflammatory bowel disease	0	0	1	2	1	2	**6**
Failed enteral feeding	0	1	0	0	3	3	**7**
Infarcted bowel	2	1	1	2	0	2	**8**
Other	4	4	5	1	7	3	**24**
Total	**94**	**67**	**96**	**78**	**73**	**90**	**498**

Sixty-four percent of CVCs inserted over the 6 years were single-lumen used for TPN only (Table 3). Since the introduction of a PICC insertion service in 2000, increasing use has been made of PICC lines which in 2003 comprised 45% of all insertions.

Table 3. Types of catheter used for total parenteral nutrition delivery

Catheter type	1998	1999	2000	2001	2002	2003	Total
Subclavian multilumen	23	12	16	11	8	6	**76**
Subclavian single lumen	52	30	41	21	19	17	**180**
Internal jugular multilumen	5	8	7	8	8	18	**54**
Internal jugular single lumen	6	5	3	2	4	2	**22**
External jugular double	0	1	0	0	0	0	**1**
External jugular single	1	0	0	0	0	0	**1**
PICC double lumen	0	0	2	1	2	3	**8**
PICC single lumen	2	5	28	31	32	41	**139**
Tunnelled (Groshong) double	12	14	6	7	5	9	**53**
Tunnelled (Groshong) single	1	1	0	1	0	0	**3**
Tunnelled (Hickman) double	1	0	0	0	1	0	**2**
Vas Cath triple lumen	1	0	0	0	1	2	**4**

Catheter-related bloodstream infection rates per 1000 catheter days are shown for each year in Table 4. After 1998, the rates did not change significantly and were approximately half the rate recorded in 1998.

Table 4. Catheter-related infections

Year	Infection Rate*	95% Confidence interval
1998	5.3	2.6–9.5
1999	3.1	0.8–7.6
2000	2.0	0.4–5.9
2001	2.4	0.4–6.0
2002	1.4†	0.2–4.7
2003	2.1	0.6–8.1
All years	2.9	1.9–4.2

*Number of infections per 1000 TPN days; †P<0.05 versus 1998.

Discussion

This report provides summary data on TPN usage and associated septic complications for the purpose of describing local practice, recognising trends, identifying issues that may be amenable to quality improvement initiatives, and, finally, providing a benchmark against which results from other centres may be compared.

This review covers a 6-year period beginning with the appointment to the NST of a specialist TPN nurse and ending with the amalgamation of Auckland and Greenlane Hospitals in the latter half of 2003. From 2004, the NST began taking referrals from departments previously located at Greenlane Hospital.

Paralytic ileus following abdominal surgery was the most common reason for patients requiring TPN. Approximately 80% of patients were placed on TPN because of paralytic ileus, enterocutaneous fistula, small bowel obstruction, anastomotic leak or bone marrow transplant and this proportion was consistent across all 6 years.

The total number of patients requiring TPN each year and number of TPN episodes has remained essentially static over the 6-year period of this review. The median duration of these episodes has, however, reduced by 45%. This reduction was clearly apparent in the paralytic ileus group and similar trends were seen for patients with small bowel obstruction or perforation (data not shown).

While we do not have a definitive explanation for this drop in TPN usage, it is likely that an underlying reason was a shift towards a more aggressive approach to initiation of enteral or oral feeding where increasingly larger gastric aspirate volumes (up to 1000 mL) were tolerated before TPN was stopped.

Catheter device selection involves consideration of multiple issues including the patient's vein physiology, coagulation status, expected length of therapy and requirement for multiple access. Although published studies have shown conflicting results, multilumen catheters are generally thought to be associated with a higher sepsis rate than single lumen and those used for TPN administration are considered to be of greater risk.[6]

The Centres for Disease Control and Prevention (CDC) recommend use of a single lumen CVC unless multiple ports are essential for patient management.[7] Our policy is to provide a new single lumen CVC for TPN administration and the line should not be used for other purposes. However use of a dedicated lumen of a multilumen CVC is sometimes unavoidable. In 1998, PICCs were used for TPN in only 2% of cases while in 2003 this proportion had increased to 45%, reducing the requirement for subclavian placement by more than 50%.

As the majority of these PICCs are placed by a nurse led service using sterile technique, the demand for line placement for our busy anaesthetists has been reduced. While patient specific factors are always considered, PICCs are now our first choice for TPN administration. In addition to expediting line insertion, access to such a PICC service may also be expected to result in cost savings. The cost-effectiveness of PICC lines has been challenged, however, by Cowl et al[8] who carried out a randomised trial comparing costs and complications for PICC and subclavian lines for TPN.

These authors found significantly higher institutional costs associated with the former largely because of the higher thrombophlebitis rates. It should be noted that Cowl et al[8] used silicone elastomer PICCs which are associated with higher phlebitis rates than polyurethane catheters.[9] Polyurethane 4F (18 gauge) PICC lines are used in our institution. In patients not receiving PICC lines our preference is for the subclavian route over the internal jugular principally because line care, particularly in relation to maintaining dressing integrity, is easier to manage in the former.

No randomised trials have been published comparing the internal jugular and subclavian routes for incidence of complications. Systematic reviews published in 2002 found that malpositioning occurred less often with the jugular approach[10] while subclavian CVCs were associated with lower risk of CRBSI.[10,11] These general principles are reflected in the type of lines used as shown in Table 3.

The patients in our study receiving TPN via tunnelled catheters were generally bone marrow transplant patients who routinely have these catheters placed. On rare occasions TPN has been delivered through the middle lumen of a Vas Cath where the patient is receiving dialysis and placement of a separate line is contraindicated.

TPN carries a high risk of catheter-related blood stream infection[12] and this remains the most common and potentially devastating complication of this therapy, frequently occurring from touch contamination.[13] Such complications contribute to patient morbidity and result in increased length of hospital stay with substantial associated costs of care.

The CDC recommends that infection rates be expressed as CR-BSI per 1000 catheter days.[7] Use of CR-BSI per 100 catheters (or percentage of catheters studied), although often reported, does not adjust the risk for the number of days the catheter is in use. Owing to differences in the criteria used to define CR-BSI, direct comparison of infection rates found in the current study with other published studies is difficult.

Duerksen et al[14] reported an infection rate of 1.4 per 1000 days for their analysis of 1995/96 data. Over the three-year period 1994-6, following introduction of PICCs, their reported data indicate an infection rate of 1.7/1000d. Our data yield an aggregate infection rate of 2.0/1000d for the four years since introduction of a PICC service in 2000. The rates from these two groups, both of which involve an established NST and similar frequencies of TPN use, are very similar.

In our series, and as reported by Duerksen et al, [14] increasing use of PICC lines was not associated with significant reduction of CR-BSI. The randomised trial by Cowl et al[8] also showed similar infection rates for PICC and subclavian lines while a recent systematic review[15] found a CR-BSI rate of 2.1 per 1000 d for PICCs and a slightly higher rate (2.7 per 1000d) for CVCs inserted via the subclavian or internal jugular routes.

Prevention of CR-BSI remains a concern and a challenge. Understanding the aetiology and pathogenesis provides a basis for the development of evidence-based protocols to guide practice. Providing education and monitoring practice of health professionals managing CVCs through specialist nutrition support nursing staff as integral members of an NST have been shown to be effective in reducing infection rates.[16–18]

Similarly, in the current study, the appointment of a specialist TPN nurse in 1998, whose role is to provide appropriate education to ward nursing staff, to participate in the development and review of standards of care for nutrition support, and to monitor the handling of CVCs, appeared to be associated with maintenance of acceptably low rates of CR-BSI after 1998.

It is important to note that a single TPN nurse was continuously employed over the period of this review and the CR-BSI rates achieved provide a benchmark for comparison with other centres and also with data since 2004 from Auckland City Hospital which will be the subject of future reports.

The goal of our NST is to provide an appropriate, safe and cost-effective service. Because of the inherent risk and higher cost of parenteral nutrition it should not be used if enteral feeding is feasible.[19] A database for all TPN use in this hospital is a

useful tool for recognising trends and quantifying outcomes and such information, in addition to allowing comparison with other centres, is a valuable resource for both the TPN service and the institution.

Competing interests: None known.

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Implementation of a pharmacist medication review clinic for haemodialysis patients

Sanja Mirkov

Abstract

Aims To implement the Pharmacist Medication Review Clinic and establish a sustainable clinical pharmacy service.

Methods Prospective clinical medication review conducted by trained clinical pharmacists using standardised tools. Pharmacists' intervention included medication recommendation and patient education.

Results From December 2007 to July 2008, medication reviews were conducted with 64 haemodialysis patients. Patients were taking on average 13 medications. Drug-related problems (DRPs) were identified in 92% of medication reviews (a total of 278 DRPs). The major DRP was non-adherence with medication regimen (33%), followed by medication requiring dose decrease (9.3%) and indication requiring new medication (8.6%). The risk factors for multiple DRPs were ethnicity, length of time on dialysis and age. New Zealand (NZ) Māori and Pacific Peoples were more likely to have more than three DRPs compared to patients of European descent. (NZ Māori: OR 7.49, 95%CI 1.15–48.9, p=0.035; Pacific Peoples: OR 5.4, 95%CI 0.96–30.34, p=0.055) and patients who spent 3.5 to 6.3 years on dialysis (OR 7.48, 95%CI 1.45–38.76, p=0.016). Patients older than 55 were less likely to have more than three DRPs compared to younger patients (OR 0.14, 95%CI 0.03–0.69, p=0.016).

Conclusions Pharmacist-led medication review clinic identified drug-related problems (DRPs) and risk factors for DRPs in haemodialysis patients.

The annual incidence rate of end-stage renal disease (ESRD) in New Zealand is around 117 per million population. In 2006, of total 3224 patients receiving renal replacement therapy, 1971 were dialysis patients (476 per million population) and 1253 were transplant patients.

The number of patients receiving dialysis is increasing from 1776 patients in 2004 to 1971 patients in 2006 while the number of transplant patients remains the same (1220 patients in 2004 and 1253 patients in 2006). Diabetic nephropathy is the most common cause of ESRD (42%) followed by glomerulonephritis (21%) and hypertension (12%).[1]

Although ESRD is uncommon, its treatment with dialysis or transplantation is very expensive. In New Zealand (NZ), ESRD patients represent 0.07% of total population and the total expenditure on ESRD is about 0.91% of total health expenditure.[2]

Hospitalisation is the major component of the cost of the care of patients on dialysis.[3,4] In 2003, there were 747 hospital admissions for ESRD patients with an estimated cost of NZ$7.4 million.[2]

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ESRD is more common in ethnic minority populations. The age- and sex-standardised incidence of ESRD among adult Māori and Pacific Peoples is 2–10 times higher than the rates seen among non-indigenous New Zealanders and non-indigenous Australians.[5] This, together with lower rates of transplantation, leads to a higher prevalence rate of dialysis patients.

Approximately half the total dialysis patients in New Zealand are patients of Māori (678) and Pacific Peoples descent (363).[1]

The study by Plantiga et al demonstrated that attainment to clinical performance targets for dialysis patients such as albumin (≥40.0 g/L), haemoglobin ≥110 g/L, calcium–phosphate product <4.44 $mmol^2/L^2$, dialysis dose (Kt/V≥1.2) and vascular access type (fistula) was associated with better patient outcomes, such as decreased hospitalisation, number of hospital days, and associated cost and better survival.[6]

Appropriate management for advanced CKD and associated comorbid conditions are not routinely instigated despite the presence of potentially modifiable factors. Interventions to reduce morbidity and cost of care after initiation of dialysis are highly recommended.[7]

Drug therapy is an essential part of the medical management of patients with ESRD receiving dialysis, it is also a major contributor to preventable morbidity.[8] Patients with ESRD take multiple medications and have complex medication regimens requiring regular monitoring. Frequent medication changes increase the risk of inaccurate medication profiles and therefore create adherence problems for patients. Subsequently, the incidence of DRPs is high, leading to an increased risk of medication-related hospital admissions.

Studies in other patient groups have shown that optimum medication use is associated with improvement in patient outcomes and also reduction in medication cost.[9–12] However, the incidence of preventable drug-related morbidity is often overlooked by clinicians and hospital managers.[8]

Drug-related problems (DRPs) are a major source of hospital admissions. One study reported 28% of hospital admissions being due to drug-related problems.[13] Inadequate patient history information is the second leading cause of reported error with 24% of error being attributed to lack of details about the patient.[14]

It has been demonstrated that patients taking multiple medications are most likely to have drug-related problems.[15] Of this group, 73% of problems were only recognised through a patient interview, suggesting that an interpersonal relationship is critical to the provision of pharmaceutical care.[15]

Identification and resolution of DRPs can occur through provision of pharmaceutical care—a practice in which the pharmacist takes on the responsibility of the patient's drug related needs, and is held accountable for this commitment.[16]

Provision of clinical pharmacy service/pharmaceutical care to dialysis patients is a cost-effective way to identify, resolve, and avoid DRPs.[17] Involvement of patients and their carers in making decisions about their medications and having a better access to information can contribute to the safer use of medicines. Patients who understand their own medication regimen are better placed to identify and prevent prescribing, dispensing and administration errors.[18]

The role of the clinical pharmacist in the dialysis unit has been well established in Canada,[19] USA[20–25] and UK.[18] In 2002, a study[26] at In-centre Dialysis Unit at Middlemore Hospital demonstrated that structured medication reviews are necessary for identification of actual and potential DRPs, treatment monitoring and adjustments.

The Medication Review Clinic (MRC) for dialysis patients increased awareness of staff and patients of preventable drug-related morbidity and improved the standards of medication use in dialysis patients at the In-Centre Dialysis Unit.

The establishment of formal pharmacist-led medication review clinic was required as a prerequisite for further service development and assessment of the benefits in this particular patient population. In 2007, a business case for a clinical pharmacist (0.5FTE) for a pharmacist–led medication review clinic was approved by the Renal Department at Middlemore Hospital. The objectives of the service are listed below in Figure 1.

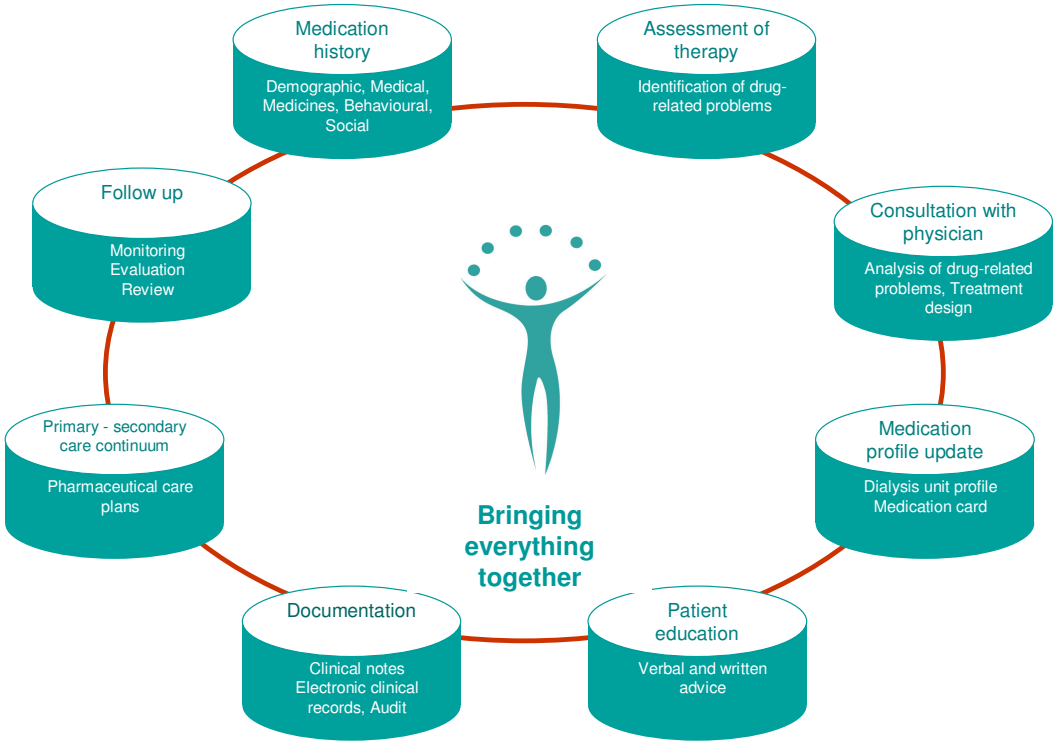
Figure 1. Objectives of the Medication Review Clinic

- Prevention and early detection of drug-related problems (DRPs)
- Provision of accurate medication profiles
- Prevention of medication errors occurring at admission or transfer of care in chronic dialysis patients
- Reduce doctors' time spent on medication review and allow additional time for review of medical problems
- Provision of medication education to patients
- Improve communication among patients and health care professionals
- Increase patient motivation
- Increase patients' adherence
- Primary-secondary care continuum improvement

The process a shown in Figure 2 below for dialysis patients was established at Middlemore Hospital[26] to perform medication reviews.

The aim of this study was to implement the Dialysis Medication Review Clinic and establish a sustainable clinical pharmacy service.

Figure 2. Medication review clinic process



Methods

Prospective clinical medication reviews were conducted by four clinical pharmacists, three of whom had completed the training programme provided by senior clinical pharmacist and renal hospital medical officer. Medication reviews were conducted using a standardised process (Figure 2) and standardised clinical tools including the medication review pathway and the patient pack (Figure 3) previously developed.[26]

Included in the study were patients from two adult haemodialysis units prior to their six monthly nephrologists' review. Patients were selected from the renal clinic appointment list sequentially. Medication reviews were performed one week prior to the nephrologists' review.

Excluded from the study were patients who were admitted to the hospital, dialysing in other dialysis units, and those who were dialysing not within clinical pharmacy service hours. Patients included in the study also signed an informed consent form.

Medication histories from the previous nephrologists' review letters were reconciled with the medication lists from general practitioners (or retirement villages), community pharmacies, dialysis unit records and patients' own medications. Clinical and laboratory assessment was conducted using the Medication Review Clinic Pathway.[26]

This pathway consists of 13 sections and each section summarises relevant laboratory and clinical assessment data and also has a medication section. The pharmacists were prompted to perform a comprehensive medication review, and provide a summary for clinic documentation.

The 13 sections of the pathway are: anaemia management, chronic kidney disease – bone and mineral disorder, hypertension and cardiovascular complications, hyperlipidaemia, infection, diabetes mellitus,

asthma/chronic obstructive airways disease, gout, pain management, therapeutic drug monitoring, other conditions, notes/follow-up section and summary of DRPs.

Urgent DRPs were discussed with the senior hospital medical officers within the unit. The pharmacists' recommendations were peer reviewed and the medication history and a summary of drug related problems was outlined in the clinic letter published in the patient electronic hospital record.

Patients were provided with education on their medications and given a folder (Patient Pack) containing a medication card, self-monitoring form and patient information leaflets. The medication records in the dialysis unit were subsequently updated. Patients also received a follow up appointment after the nephrologist's review to ensure medication changes were implemented.

Drug-related problems were classified using a modified version of the classification developed by Hepler and Strand 1990[16] into the following categories: non-adherence with medication regimen, indication requiring new medication, unnecessary medication use, improper drug selection, medication requiring dose increase, adverse drug reaction, drug interaction, medication requiring dose decrease, failure to receive medications and other.

The data was collected prospectively using Microsoft Excel and analysed using Stata IC version10 (StataCorp, College Station, TX). Multivariate logistic regression with entry of variables at a significance level of 0.2 from univariate and stepwise rejection of variables at the 0.05 level of significance were used to examine the potential correlates for risk for multiple drug-related problems (greater than median number of DRP). The variables were age, gender, ethnicity, length of time on haemodialysis (vintage), number of medications and self-medication.

Figure 3. Medication Review Clinic Tools

Patient pack

- Computer-generated medication card
- Self-monitoring sheet for dialysis patients on renal bone disease, anaemia and potassium control
- Patient information leaflets

Medication Review Clinic Tools

- Patient consent form
- Medication history form
- Medication Review Clinic Pathway
- Clinic letter published on electronic hospital record

Results

From December 2007 to July 2008, medication reviews were conducted with 64 haemodialysis patients at two adult haemodialysis units at Middlemore Hospital.

Patient demographics are presented in Table 1. By the end of the study period, three patients had died.

Table 1. Patients demographics

Variables	Number (n=64)
Gender (female)	39
Age (median and range) years	65 (24–82)
Length of time spent on dialysis, years (median, range)	4.9 (0.1–20.2)
Number of medical conditions (median, range)	9 (4–16)
Number of medications (median, range)	13 (4–25)
Number of patients looking after own medications	40
Number of patients using compliance package	17
Ethnicity	
Pacific Peoples	30 (46.9%)
NZ Māori	16 (25%)
European	13 (20.3%)
Other	5 (7.8%)
Cause of ESRF	
Diabetes mellitus	32 (50%)
Glomerulonephritis	13 (20.3%)
Hypertension	3 (4.7%)
Polycystic kidney disease	2 (3.1%)
Other	14 (21.9%)

Drug-related problems (DRPs) were present in 92% of the medication reviews conducted. A total of 278 DRPs were identified (with a median of three DRPs per patient). The main drug related problem identified was patient non-adherence with prescribed regimens (33%) followed by excessive dose (9.3%) and untreated indication (8.6%). Pharmacists adjusted the dialysis unit records for 173 medications.

In this population sample, NZ Māori patients were seven times more likely to have three or more DRPs compared to patients of European descent. (OR: 7.49, 95%CI 1.15–48.9, p=0.035). Pacific Peoples were more likely to have three or more DRPs compared to patients of European descent; however the finding was not statistically significant. (OR: 5.4, 95%CI: 0.96–30.34, p=0.055).

Patients older than 55 years were less likely to have three or more DRPs compared to younger patients. This was statistically significant for middle tertile age category—i.e. 55 to 68 years (OR: 0.14, 95%CI: 0.03–0.69, p=0.016) and not statistically significant for upper tertile age category 69 to 82 years (OR: 0.22, 95%CI: 0.05–1.03, p=0.055).

Patients who had been on dialysis for a longer period of time were more likely to have three or more DRPs. Patients who spent from 3.5 to 6.3 years on dialysis (middle tertile) were more likely to have 3 or more DRPs than patients who had less than 3.3 years on dialysis (OR: 7.48, 95%CI: 1.45–38.76, p=0.016). This finding was not statistically significant in patients who spent more than 6.7 years on dialysis. (OR: 2.27, 95%CI: 0.48–10.79, p=0.304)

Gender, the number of medications taken and whether the patient was self-medicating did not have a statistically significant influence on multiple DRPs in our population sample.

On average the medication review took 108 min per patient. This, included preparation time, the actual patient interview, communication between community and hospital services and subsequent patient education.

A summary of the pharmacist interventions for this study including a description of the drug-related problems found is presented in Table 2.

Table 2. Pharmacists' medication review interventions

Variables	Number (n=64)
Total number of interventions	493
Median number of interventions per patient (range)	5.5 (0–31)
Number of medication records adjustments	173
Number of patients reminded of doctor's appointment	18 (28%)
Number of medications disposed with patient consent	24
Number of drug-related problems	278
Median number of DRPs per patient (range)	3 (0–15)
Non-adherence	91 (32.7%)
Medication requiring dose decrease	26 (9.3%)
Indication requiring new medication	24 (8.6%)
Failure to receive medication	18 (6.5%)
Laboratory tests ordered	17 (6.1%)
Unnecessary medication use	16 (5.7%)
Medication requiring dose increase	12 (4.3%)
Adverse drug reaction	12 (4.3%)
Improper drug selection	6 (2.1%)
Drug interaction	4 (0.7%)
Other	52 (18.7%)

Tables 3 and 4 represent the clinical summary of data regarding the management of anaemia, Chronic Kidney Disease-Bone and Mineral Disorder (CKD-BMD) and diabetes mellitus.

Table 3. Anaemia management

Variables	Number (n=64)
Number of patients on Erythropoietin	62
Number of patients self-medicating with Erythropoietin	23
Median Erythropoietin dose per week (units) range	15,000 (2000–30,000)
Number of patients prescribed	
Intravenous iron	50
Ascorbic acid tablets 100 mg	8
Folic acid tablets 5 mg	15
Median laboratory values (interquartile range)	
Haemoglobin g/L	114(106–121.5)
Ferritin µg/L	703 (501–896)
Iron saturation	0.3 (0.235–0.365)

Reference range for ESRD patients: haemoglobin 110–120g/L, ferritin >100 µg/L, iron saturation >0.2

Table 4. Chronic kidney disease – bone and mineral disorder

Variables	Number (n=64)
Number of patients taking calcitriol	48
Median doses	
Calcitriol (µg/week)	1.5
Calcium carbonate 1250 mg tab (number per day)	6
Aluminum hydroxide 600 mg tab (number per day)	6
Median laboratory values (interquartile range)	
Serum calcium (mmol/L)	2.45 (2.3–2.6)
Serum phosphate (mmol/L)	1.85 (1.37–2.16)
Calcium phosphate product ($mmol^2/L^2$)	4.6 (3.25–5.37)
Parathyroid hormone (pmol/L)	67.4 (33.4–120.75)
Serum aluminium (µmol/L)	0.4 (0.2–0.9)
Serum albumin (g/L)	37 (35–40)

Reference range for ESRD pateints: serum calcium 2.37–2.54 mmol/L, serum phosphate 1.13–1.78 mmol/L, calcium phosphate product <4.4, parathyroid hormone 16.5–33 pmol/L, serum aluminium <2.2 µmol/L, serum albumin 35–47 g/L

Discussion

Medication reviews for dialysis patients are complex to manage due to multiple medications, multiple indications, frequent dose changes, multiple health care providers and patient adherence issues.

This prospective study demonstrated that NZ Māori and Pacific Peoples, young patients and patients who spent more than 3.5 years on dialysis are at increased risk of multiple drug-related problems (DRPs).

The major drug related problem identified in our study was patient non-adherence with prescribed medications i.e. one third of total DRPs were related to non-adherence with medication regimen. Ethnicity was found to be a risk factor for multiple drug-related problems when adjusted for patient's age and length of time on dialysis. Although this was not statistically significant for NZ Māori in this small sample size a trend has been observed.

Drug-related problems found to be a major source of hospital admissions.[13] New Zealand Māori and Pacific Peoples have particularly high hospitalisation rates. According to Jackson at al[27] 38% of all NZ Māori and 40% of all Pacific Peoples hospitalisations are preventable.

The management of chronic kidney disease - bone and mineral disorder (CKD-BMD) was suboptimal in our patient population and requires a novel approach. Poor serum phosphate control has been associated with an increased risk of mortality and morbidity.

The greatest risk of mortality was found for serum calcium levels greater than 2.5 mmol/L, serum phosphate levels greater than 2.1mmol/L and parathyroid hormone levels greater than 63 pmol/L.[28] In New Zealand there is a lack of fully funded treatment options for this particular condition. Two phosphate binders (calcium carbonate and aluminium hydroxide), two oral forms of vitamin D (calcitriol

and alphacalcidiol) are fully funded while calcimimetics are not funded by PHARMAC (Pharmaceutical Management Agency, a Crown entity established by the New Zealand Health and Disability Act 2000 and directly accountable to the Minister of Health).

The study demonstrated that clinical pharmacists can be taught to perform structured medication reviews for dialysis patients using the standardised MRC tools. The total number of DRPs identified and the number of DRPs per patient was similar to the number previously reported.[25] The time spent in this study on medication review was similar to that found by Curtis at al[19] previously. Pharmacists' time spent on medication review was similar to the findings in the study by Curtis at al.[19]

The benefits of pharmacists' medication reviews on hospitalisation and mortality in patients on dialysis have not been formally evaluated.

A systematic review[29] of randomised controlled trials of pharmacists' care of patients with heart failure revealed that this care was associated with reduced risk of overall and hospitalisations for heart failure (OR: 0.69, 95%CI 0.51–0.94). Collaborative care (pharmacist as a member of multidisciplinary team) led to a greater reduction in hospitalisation (OR: 0.42, 95%CI: 0.24–0.74) than pharmacist-directed care (i.e. pharmacist-initiated and managed intervention) (OR: 0.89, 95%CI: 0.68–1.17).

Another systematic review[30] and meta-analysis[31] of the effect of pharmacists' interventions on patients with diabetes mellitus demonstrated that pharmacist intervention improved glycosylated haemoglobin (HbA1c). The pharmacists' interventions had greater effect when pharmacists had prescriptive authority.[30] A systematic review and meta-analysis[32] of pharmacists' medication reviews in the geriatric population aldo showed that pharmacists' medication reviews improved drug knowledge and adherence, however did not have any effect of reducing mortality or hospital admissions.

Previous research has demonstrated that multidisciplinary clinics in chronic disease management improve patient outcomes. However, to dates single randomised controlled trial in patients with kidney disease published[33] did not demonstrate benefits to case management in chronic kidney disease. The failure of this study may have been due to the failure of primary physicians to implement recommendations made from the multidisciplinary clinic.

The case control study[19] conducted in Canada and Italy demonstrated the additional value of the multidisciplinary team in optimising both short and long-term patient outcomes including survival advantage. The authors suggested that further research is required to determine which specific components of care are most important with respect to positive outcomes.

The main barriers identified to establishment of medication review clinic are listed in Figure 4.

Figure 4. Barriers to establishing a Medication Review Clinic

Attitudinal barriers

- Pharmacists' attitudes towards new clinical roles and services
- Doctors – pharmacists relationships

Limitation of pharmacy profession

- Political and legal aspects
    - Lack of collaborative prescribing rights
- Recognition
    - Lack of clinical career pathways for pharmacists

Internal considerations

- Pharmacy department strategies and priorities
- Pharmacy staff expertise, interests, resources

External considerations

- Patient demographics
- Health care needs

The attitude of the pharmacists was addressed by the provision of a training programme and standard processes for service delivery. The Medication Review Pathway (as shown in Figure 2) ensured the quality standards of care were met and delivered to all patients. The pharmacists' recommendations were peer reviewed by a senior renal pharmacist before data was entered in the patients' electronic medical record.

Political and legal aspects are recognised major factors in influencing the future development and maintenance of medication review clinics for patients with chronic diseases. The UK National Service Framework for Renal Services, Department of Health, envisaged that, pharmacists and nurses as supplementary prescribers, possibly could run clinics for patients with chronic renal disease, and manage typical chronic medical conditions such as hypertension, anaemia, and renal bone disease.[18]

Provision of such a service in the outpatient hospital setting overcomes the issues relating to pharmacists' access to patients medical and laboratory data, however supplementary prescribing for clinical pharmacists working in the hospital outpatient clinics would secure the continuum of this pharmacists' role for the future.

A number of interventions aimed at improving adherence have been applied in the present study such as provision of the medication card alongside verbal and written patient education, simplified dosing and involvement of patients in their own care through self-monitoring of monthly serum phosphate and calcium levels, haemoglobin and serum potassium.

Future research should focus on developing specific educational packages about pharmacotherapy for NZ Māori and Pacific Peoples.

The major limitations of the study was a small sample size and lack of a control group. Assessment of outcomes was not attempted at this stage. A randomised control trial is needed to assess the impact of pharmacist intervention on hospitalisation and patients' quality of life.

A total study size of 400 pre-dialysis and dialysis patients, (200 receiving pharmacist intervention and 200 receiving usual care) is necessary to detect a true difference of 15% of hospitalisation rate at 12 months and ensure the power of the study of 80% at the significance level of 5%.

Conclusion

Pharmacist-led Medication Review Clinic for haemodialysis patients in an outpatient setting resulted in the identification of drug-related problems and risk factors for such problems. As drug-related problems are likely to exist at a high frequency in patients on dialysis, the inclusion of a clinical pharmacist as a member of the multidisciplinary healthcare team taking care of patients on dialysis may be beneficial.

Competing interests: None known.

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Laparoscopic splenectomy and the treatment outcomes for idiopathic thrombocytopaenic purpura at North Shore Hospital

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Abstract

Aim Firstly, the demographics of laparoscopic splenectomy cases at North Shore Hospital (Takapuna, Auckland, New Zealand), the outcomes of operative technique, and perioperative complications by a single surgeon were reviewed. Secondly, analysis was performed on patients with idiopathic thrombocytopaenic purpura (ITP) with regard to platelet response and detection of preoperative predictors.

Methods Laparoscopic splenectomy patients from 1998 to 2007 were reviewed with respect to demographics, operation and their complications. ITP outcomes, analysed separately, were categorised as complete remission for postsplenectomy platelet counts greater than 150×10^9/L, partial remission as $30–149\times10^9$/L and refractory as platelet counts less than 30×10^9/L. The relationships between preoperative steroid, immunoglobulin transfusion and operative outcomes were analysed.

Results 29 (67%) out of 43 laparoscopic splenectomies were for ITP. For ITP cases, 19 (65%) achieved complete remission and six (21%) partial remission at 3-month follow-up. Follow-up detected that two cases in each group had relapses after 3 months. Explorative data analysis suggested that a lack of preoperative transfusion may predict an approximately 80% chance of complete remission postsplenectomy. There was one conversion to an open splenectomy and no mortality with minimal complications.

Conclusion Cumulatively, in 86% of cases, laparoscopic splenectomy created a significant increase in platelet counts at 3-month postoperatively without any long-term morbidity. Although not strongly demonstrated, preoperative immunoglobulin transfusion may be correlated with remission.

Since its conception in the early 1990s, laparoscopic splenectomy has become a well-established procedure for splenic pathology. Treated conditions include ITP, haemolytic anaemia and moderate splenomegaly due to aetiology such as cysts, lymphoma and hereditary spherocytosis.[1,10] Elective laparoscopic splenectomy has been documented with cases reports as a safe procedure with little morbidity and quicker recovery times than the open approach.[1,3] The most common condition treated with laparoscopic splenectomy is ITP, naturally assisted by the fact that it does not usually result in splenomegaly and therefore allows safe extraction via this approach.

Patients with ITP are often offered laparoscopic splenectomy after medical treatment is considered refractory. The period of attempted medical therapy, varies amongst haematologists mainly because there are no set guidelines regarding the duration of

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medical management before referral for surgery. In addition, other factors such as age and lifestyle need to be accounted for during decisions for referral.[3]

However, general guidelines recommend splenectomy be deferred for at least one month after diagnosis and oral steroids plus/minus intravenous immunoglobulin be administered for symptomatic or severely thrombocytopenic patients (<10×10^9/L), in order to allow time for medical remission.[3]

Numerous studies have consistent results of approximately 66% complete remission from second line treatment of ITP with laparoscopic splenectomy.[2,8] Age, although poorly defined in the literature, appears to be the only consistent positive predictive factor with younger patients having more a favourable response from splenectomy according to a systematic review of several retrospective series.[5,9]

Method

North Shore Hospital electronic databases were searched from 1998 to 2007 to identify all patients who had undergone laparoscopic splenectomy as a primary procedure. The current and pre-2002 databases were searched and open splenectomies were omitted. There was one laparoscopic splenectomy undertaken as a secondary procedure during partial pancreatectomy and a primary laparoscopic marsupialisation of a splenic cyst and these were omitted from the series.

Patient population—Hospital records were reviewed and data was collated for patient age, gender, ethnicity, diagnosis, time from diagnosis to operation, pre-op prednisone dose, and pre-op, intra-op and post-op values of immunoglobulin transfusions and platelet counts for ITP. Data was also gathered for presence of spleneculum, operative times, hospital stay, intraoperative and postoperative complications, outcomes (in terms of post-operative platelet counts for ITP cases), conversions to open, splenic weight and dimensions, and follow-up times.

Definitions—All laparoscopic splenectomies were carried out in a standard fashion with the patient in the left lateral position. In all cases, four instrument ports were used except in one, where a Hand Assisted laparoscopic splenectomy was performed and a hand port was inserted. All operations were carried out by a single surgeon. A linear vascular stapler (Tyco Healthcare Autosuture™ Endo GIA™ 12 mm stapler with Endo GIA™ universal straight 45–2.0 mm vascular staples) was used to secure the short gastric pedicles and a harmonic scalpel (Tyco Healthcare Ligasure™ vessel sealing instrument) was used to dissect the other ligamentous attachments of the spleen.

The spleen was retrieved through the umbilical port in an endocatch bag, after mulching it intracorporeally utilising a suction catheter (Rocketmedical size 12 Karmen™ catheter). None of the patients had preoperative embolisation or intraoperative adrenaline injections. Theatre times actually included anaesthesia and patient preparation times as well. Splenic size was measured as a single value for the largest recorded dimension.

For ITP cases, the pre-operative platelet counts recorded were the lowest value immediately 2 weeks before the splenectomy. Post-operative platelet counts were gathered at the three-month post-operative time. Biochemical classification of splenectomy response into complete remission was a platelet count of greater than 150×10^9/L, partial remission was from $30–150\times10^9$/L and refractory was less than 30×10^9/L. Transfusion history was defined as intravenous transfusion of either platelets or immunoglobulin 1 week before laparoscopic splenectomy. Immunoglobulin transfusions used Intragram (trade name) that contains 90% IgG. Pre-operative steroid use was defined as prednisone use within 1 week of laparoscopic splenectomy.

Statistics—One tailed t-test was carried out to determine significance of difference between pre-op and post-op platelet counts in the complete remission, partial remission and refractory groups for ITP. Partition tree analysis was carried out to find a relationship between transfusion history, as defined above and postoperative outcomes in ITP cases. Descriptive statistics compared preoperative prednisone use within the various ITP response groups.

Results

General statistics—43 patients received laparoscopic splenectomy as a primary procedure between 1998 and 2007. There were almost twice as many females (65%) than males (35%) overall. In terms of ethnicity, majority of the patients were NZ European (53%) and the most common diagnosis for referral was ITP with 29 patients (67%) (see Table 1). The demographics below are from a metropolitan hospital that provides health care to 520,000 people with approximately 149,800 outpatient and 22,765 inpatient attendees overall in 2007.

The median age for all patients in this series was 43 years with a range from 15 to 88. The median age for females was 45.5 and for males 43 years. All patients with ITP, autoimmune haemolytic anaemia, and Evan's syndrome (and one patient with hereditary spherocytosis) were taking prednisone 1 week before the operation; 33 patients (77%) did not have any previous abdominal operations.

For all splenectomies, 25 patients (42%) required transfusion of either platelets or immunoglobulin within 1 week preoperatively, 8 (19%) had intraoperative transfusions, and 7 patients (16%) postoperatively.

Table 1. Demographics of all patients referred for laparoscopic splenectomy at NSH 1998–2007

		All	%
GENDER	Females	28	65
	Males	15	35
	TOTAL	**43**	**100**
ETHNICITY	NZ European	23	53
	Other European	6	14
	Asian	5	12
	Middle Eastern	3	7
	Pacific Islander	3	7
	NZ Maori	2	5
	Indian	1	2
	TOTAL	**43**	**100**
DIAGNOSIS	ITP	29	67
	Hereditary Spherocytosis	5	12
	Autoimmune Haemolytic Anaemia	3	7
	Evans Syndrome	2	5
	Autoimmune Haemolytic Anaemia/CLL	1	2
	Lipid Histiocytosis	1	2
	Polycythaemia Rubra Vera	1	2
	Splenic Lymphoma	1	2
	TOTAL	**43**	**100**

Accessory spleens were found in two patients both of whom had ITP. The mean splenic weight was 207 grams with a range from 48 to 1600 grams and the mean splenic size was 134 mm with a range of 80 to 250 mm. The mean theatre time for all cases was 139 minutes (this included anaesthesia and patient preparation). Surgical drains were normally taken out the next day and median discharge time was day two postoperatively (day 0 being the day of operation). (see Graph 4)

One case was converted to an open procedure due to splenic laceration of a large spleen on port insertion. Two cases had endocatch bag rupture, two cases had minor technical problems with the vascular stapler that required replacement of the stapler. Two cases had serosal injury to the GI tract, which was repaired intracorporeally and two cases encountered heavy hilar bleeding which were controlled laparoscopically without consequence.

Immediately postoperatively, there was one patient with persistent severe thrombocytopaenia requiring aggressive haematological therapy, three patients had UTI and three had atelectasis all of which resolved with appropriate therapy. One patient with hand port required an operative repair for dehiscence of the wound site after discharge. There were no patients with portal vein thrombosis or overwhelming postsplenectomy sepsis.

There were no mortalities and surgical follow-up had a mode and median of 2 weeks. At the end of this study, the mean haematological follow-up was 19 months.

ITP cases—29 patients of the 43 studied, were operated on for ITP refractory to medical therapies. 17 (59%) were females and 12 were males. Once again, there was a predominance of NZ European patients making up 48% of ITP patients. (see Table 2). Most patients were did not have previous abdominal operations and were discharged on day 2 post operatively. (see Graphs 2 and 3)

Table 2. Demographics of ITP patients referred for laparoscopic splenectomy at NSH 1998–2007

		ITP	%
GENDER	Females	17	59
	Males	12	41
	TOTAL	**29**	**100**
ETHNICITY	NZ European	14	48
	Other European	5	17
	Asian	3	10
	Middle Eastern	2	7
	Pacific Islander	2	7
	NZ Maori	2	7
	Indian	1	3
	TOTAL	**29**	**100**

Table 3. Pre-op and post-op mean platelet counts and their difference in ITP patients treated with laparoscopic splenectomy

		Post Laparoscopic Splenectomy Outcomes for ITP			
		Complete Remission	**Partial Remission**	**Refractory**	**Total**
Number of patients (%)		19 (65%)	6 (21%)	4 (14%)	29
Pre-op platelet mean ($\times 10^9$/L)		35.2 [± 6.6]	39.5 [± 17.1]	14.5 [± 3.1]	33.2 [± 5.6]
Platelet mean at 6 months post op ($\times 10^9$/L)		323.6 [± 29.6]	77.2 [± 15.9]	13.5 [± 2.6]	229.9 [± 31.4]
One Tail Paired t-test	Difference of means ($\times 10^9$/L)	288.4	37.7	-1	196.6
	p-value (0.05)	0.00	0.04	0.09	0.00
Pre-op transfusion within 1 week (# Patients)	Immunoglobulin	5 (26%)	4 (67%)	4 (100%)	13
	Platelets	0 (0%)	2 (33%)	2 (50%)	4
	No transfusion	14 (74%)	2 (33%)	0 (0%)	16
Pre-op transfusion within 1 week (mean)	Immunoglobulin* (mg)	99.6	102	106	102.5
	Platelets* (units)	0	2	2	1.33
Pre-op prednisone within 1 week (mean mg)		43.7 [± 8.2]	40 [± 8.9]	58.75 [± 19.2]	45 [± 6.2]

* These mean calculations include only those patients that had transfusions

As defined in Table 3, 19 patients (65%) achieved a complete remission at 3 months postoperatively, 6 patients (21%) achieved a partial remission and the rest were refractory. Laparoscopic splenectomy made a significant difference in the complete and partial remission groups between pre-op and post-op mean platelet values as noted above.

There was a trend noted that the complete remission group required less transfusion of platelet and immunoglobulin within a week preoperatively. Subtly, the need for immunogolbulin transfusion increased over the partial remission and refractory groups within 1 week preoperatively. For the group of patients in each of the three

response columns that did receive transfusions of immunogolbulin preoperatively the means where similar.

By using a partition tree approach as an exploratory tool on the data gathered, there was a suggestion that a *lack of use of transfusion* may be a good indicator for a successful outcome in terms of *complete remission* of ITP from laparoscopic splenectomy. This interpretation is not strongly justifiable in a series with small numbers such as this.

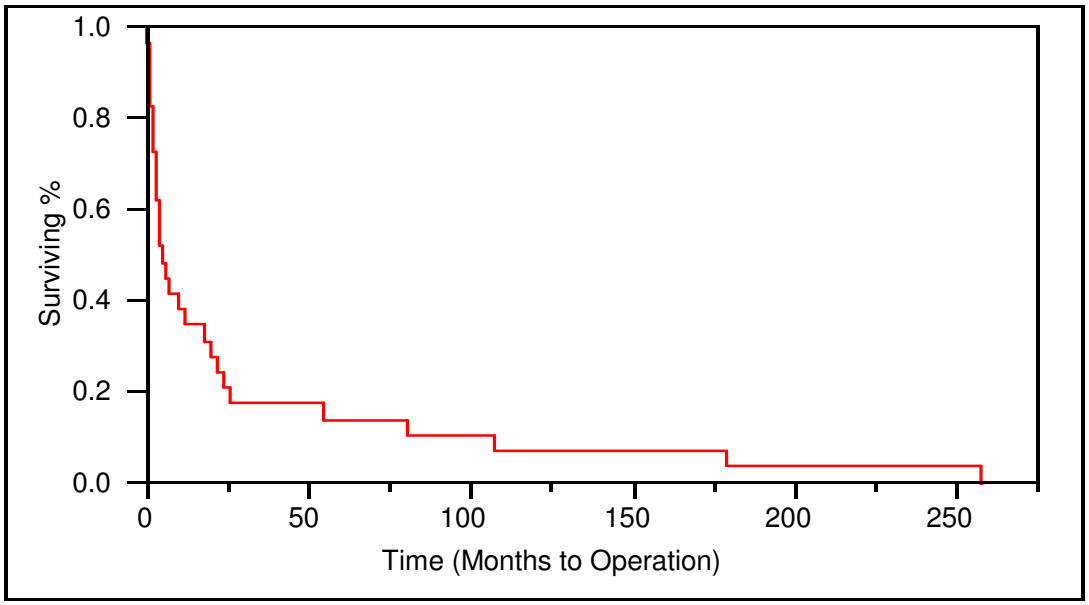
Table 4. Relationship between preoperative prednisone dose intervals and laparoscopic splenectomy response with reference to number of patients and percentage of patients

Response (# patients)				
Prednisone dose 1 week preoperative (mg)	**Complete Remission**	**Partial Remission**	**Refractory**	**Total number of patients (%)**
≤20	7 (78%)	1 (11%)	1 (11%)	9 (100%)
>20 , <60	5 (56%)	3 (33%)	1 (11%)	9 (100%)
≥60	7 (64%)	2 (18%)	2 (18%)	11 (100%)

All patients undergoing splenectomy for ITP were taking prednisone within 1 week before the operation. There were no significant differences noted within the three response groups in terms of mean pre-operative prednisone use within 1 week of splenectomy. In the complete remission, partial remission and refractory groups, the mean prednisone dose was 43.7 mg (range 0–120), 40 mg (range 0–60) and 58.75 mg (range 15–100), respectively.

When responses were investigated with regard to different pre-operative prednisone doses, the distribution of patients was uniform. As demonstrated in table 4 above, level of pre-operative prednisone dose did not convincingly demonstrate a predictor response. At each prednisone level, there was complete response in 56–78%, partial response in 11–33% and refractory cases in 11–18% of cases. There were no obvious trends noted with increased pre-operative prednisone levels. In particular, high prednisone levels did not result in poor response to splenectomy.

Figure 1. Diagnosis to operation (months) curve for ITP cases alone



The data for time of operation from diagnosis was positively skewed with a mode of one month and median of 5 months with maximum time of operation of 259 months after initial diagnosis. (see Figure 1)

Discussion

This case series of laparoscopic splenectomies carried out at North Shore Hospital is consistent with international trends with regard to the benefits and risks of the procedure. This paper has closely comparable results to other reports in the literature in the treatment of ITP.[3,8]

Laparoscopic splenectomies carried out in this case series were successfully performed for a variety of conditions, commonly ITP, in which moderate sized spleens were encountered. The long-term morbidity was close to zero with one patient requiring conversion to open and one patient requiring repair of a hand port hernia. Laparoscopic splenectomy by a single surgeon at this centre in the elective setting can be performed safely with minimal morbidity.

Most case studies have previously shown a wide range of response rates from laparoscopic splenectomy for ITP in the order of 60 to 90%.[4] This range is likely a result of studies outlining different criteria for platelet levels to define complete remission, partial remission and refractory responses and different time periods for follow-up. This study showed a complete remission of 65% and a partial remission of 21% at 3 months postsplenectomy, that is consistent with current trends.[3,8]

A small proportion of patients who were in complete or partial remission at the three month mark did have relapses after 3 months. Temporary relapses were precipitated by viral illness and one case occurred in both the complete and partial remission groups. In addition, in the complete remission group one patient relapsed at 13

months and one patient in the partial remission group relapsed at 9 months. After subtracting these late relapses, the complete remission rate for ITP was 59% and partial remission rate was 14%, which are similar to international centres.

The suggestion that lack of pre-operative transfusion may be a favourable factor for successful outcome for ITP could probably be a reflection of the aggression of the condition in a patient. However, this idea alone is not enough as a major weight in deciding to operate. In this case series, we could not find any trends with regard to use of prednisone within 1 week preoperatively and response rates.

It must be stated that the prednisone doses prior to a one-week pre-operative period were not investigated in this study. Certainly, due to different lengths of treatment with prednisone, variable doses used and ambiguity of records, an accurate study into this factor as a predictor of success is limited with this data.

Kojouri et al[2] in their systemic review of case series looking for predictors of success did not detect steroids or immunogolbulin as a reasonable predictor. There were 19 cases series that did not show steroids as a predictor and 11 that did. With immunogolbulin as a factor, seven case series did not show this as a predictor and only three were in favour of immunogolbulin as a predictor.

We could not find any accurate predictor for a complete response, but overall impression suggested that patients that did not respond to immunoglobulin were less likely to benefit from splenectomy.

In view of poor predictors in the literature, the key to success is a close relationship between the haematology and surgical services. Given that the long-term complete response rate is about 60%, careful patient selection is important.

Competing interests: None known.

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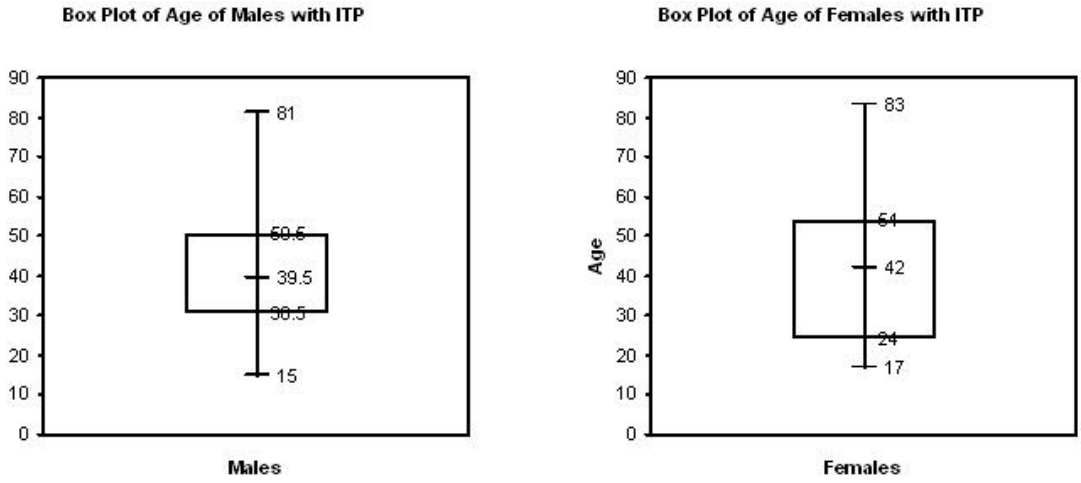
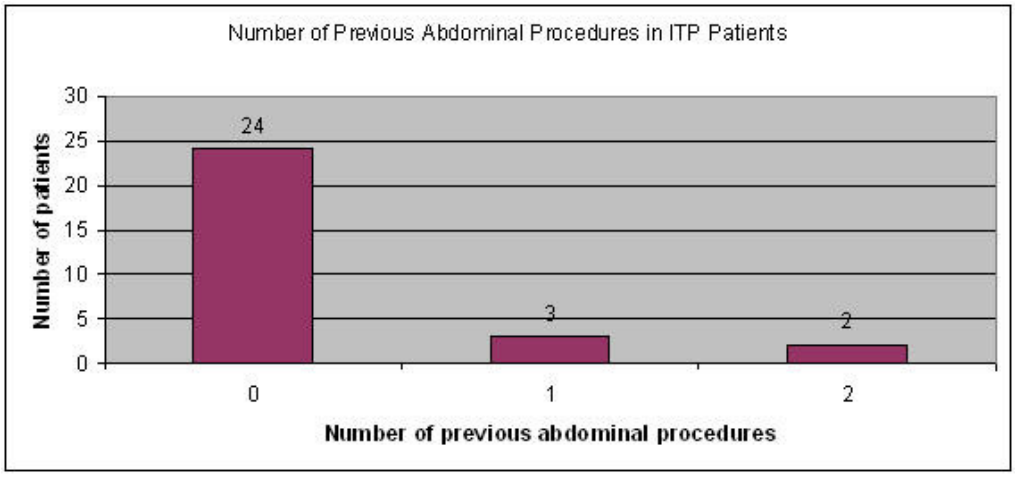
(see Appendices on next page)

Appendix 1

Graph 1



Graph 2



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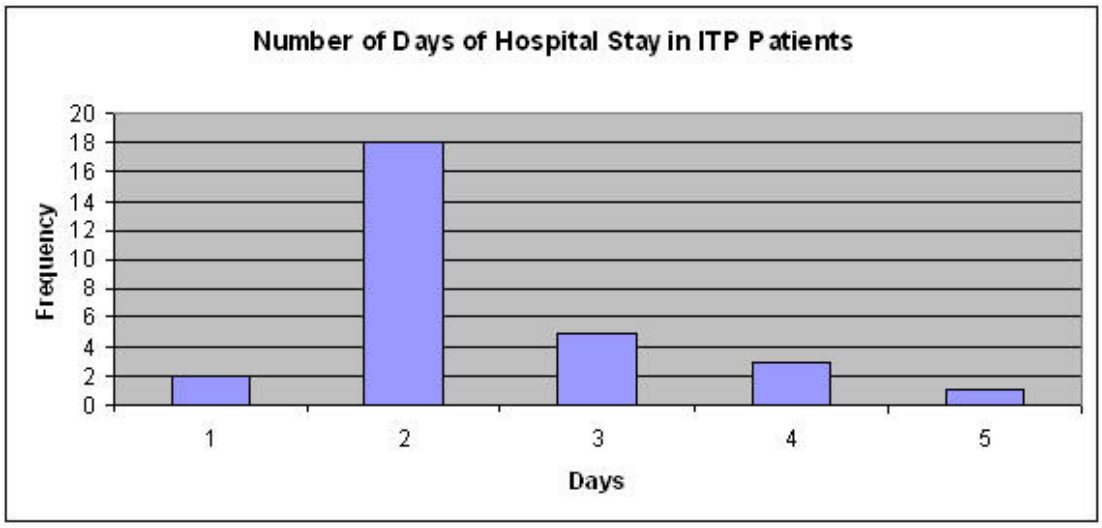
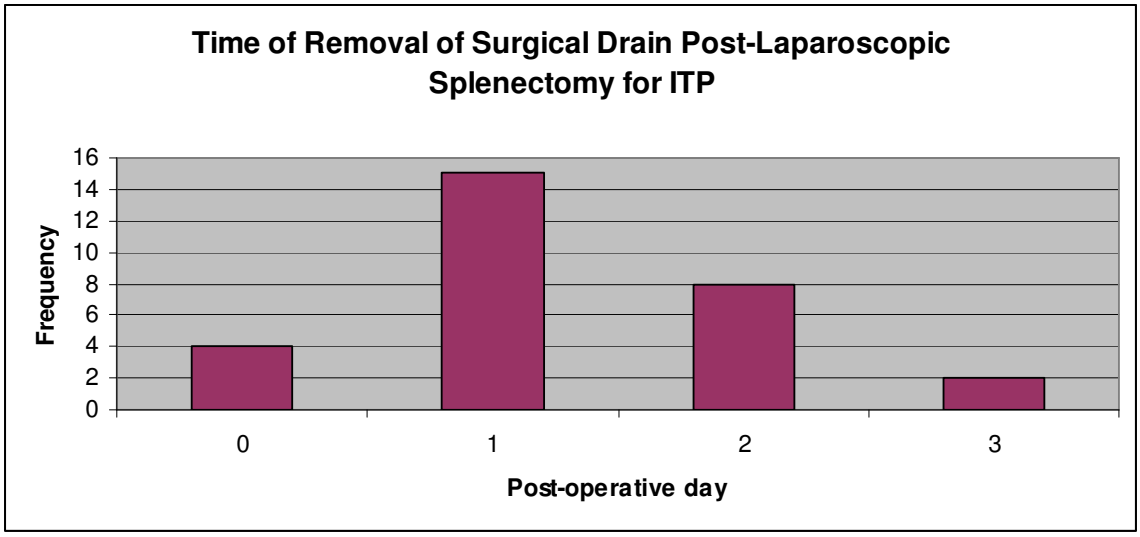
Appendix 2

Graph 3



Graph 4



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Renal stone disease in Christchurch, New Zealand. Part 1: presentation and epidemiology

Peter J Davidson, Ian G Sheerin, Chris Frampton

Abstract

Aim To document the modes of presentation and the epidemiology of radiologically diagnosed renal stone disease over a 1-year period in the region of Christchurch, New Zealand.

Method Data on the presentation and epidemiology of renal stone disease was prospectively collected in a 1-year cohort of patients who had a new radiological diagnosis of renal stone disease.

Results The incidence of new renal stone diagnoses was 105 per 100,000 per annum. Renal stone disease was more common in men than women, most common in the three decades from 30 to 59 years, and more common in people in trades or machine operating jobs. There was no significant difference in incidence by ethnicity or season. 58% of people presented with stones located in the ureter. Renal stones tended to be larger and were more likely to present incidentally or with haematuria, whilst ureteric stones were smaller and presented more typically with pain. 33% had a personal history of previous renal stone episodes and 20% had a family history of previous stones.

Conclusions Kidney stone disease is a significant health condition that affects people of predominantly working ages and men more than women. Both personal and family history are significant risk factors. Patients presenting with pain are more likely to have stones located in the ureter. Renal stones are more likely to present with haematuria or incidentally.

Stone disease in the ureter and kidney (renal stone disease) is a common and increasing disease of affluent civilisations.[1] There is little data on renal stone disease in New Zealand, and no epidemiological studies in a New Zealand population were found in a comprehensive literature search.

Studies in other Western countries indicate that approximately 15% of men and 6% of women will be diagnosed with a renal stone at some time during their lives.[2] Renal stones are associated with considerable pain, suffering, and costs to health services. Therefore, published information is of interest to health professionals involved in the diagnosis and treatment of urolithiasis, as well as to those who plan and manage health services.

This study presents for the first time information about the presentation and epidemiology of renal stone disease in a defined and complete New Zealand population. It was undertaken to document the modes of presentation and epidemiology of radiologically diagnosed renal stone disease over a 1-year period in the region of Christchurch, New Zealand.

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Method

The patient population included all patients with a radiologically confirmed new diagnosis of renal and ureteric stones in the Christchurch region between November 2001 and November 2002. Patients were eligible for enrolment if they resided in either Christchurch City or the surrounding rural areas encompassed by the Waimakariri, Hurunui, Banks Peninsula, or Selwyn Districts.

The seven radiological facilities servicing this area all used the same COMRAD package for radiological reporting. A query was designed to search for the keywords “stone”, “stones”, “calculus” and “calculi”. A daily list of all X-ray reports containing these keywords were scanned by research nurses and those containing reference to calculi or stones in either the ureter or kidney were identified. Patients were then contacted by the research nurses and, if this was the first time the stone had been diagnosed, asked to participate in the research.

In all new presenters, data was available from the radiological report on gender, age, stone size, stone position, and stone multiplicity.

Patients who signed consent (N=280) were interviewed . An additional 47 patients declined to be interviewed, but gave consent for project investigators to collect information from their medical records. In these 327 participants, information was gathered on demographics, ethnicity, occupation, income, stone presentation, family history, and past history of urolithiasis. There were another 95 people who presented with stones during the study period, but who declined to participate. These non-participants were counted in the “new radiological stone diagnoses”, but we were not able to obtain key information on them to include them in the statistical analysis in this paper.

Data was analysed using Statistical Package for the Social Sciences (SPSS, Version 13). Pearson’s, Chi-squared, and t-tests were used to test for statistical significance among presentation variables.

Results

422 new radiological stone diagnoses were made in a population of 400,250 people, giving an incidence of 105 per 100,000 per annum. 280 patients agreed to enter the study. Of the 142 that did not agree to participate, 47 gave consent to access their medical records, thus giving 327 stone presenters in whom access to medical records was possible. The reasons for declining enrolment in the trial are set out in Table 1.

Table 1. Reasons for declining enrollment

Reason for declining trial	Number
Too busy	56
Not interested	43
Elderly/unwell	29
Limited English	7
GP said “no stone”	5
Deceased	1
<6 months old	1

The 280 patients who agreed to be in the study were less likely to have stones in the kidney than the non-participants, but in all other aspects the two groups were similar (Table 2).

Table 2. Comparison between those presenting with stones who participated in the trial and those "not on trial"

Variable	On trial (n=280)	Not on trial (N=142)	P value
Age	49 (14 std)	51 (20 std)	0.18
Gender (% female)	30.4	34.5	0.39
Stone size (mm)	3 (1–50)	4 (1–22)	0.40
Stone location (% kidney)	28.9	45.1	0.001
Single vs multiple stones (% single)	75.4	77.5	0.63

Std – standard deviation

Of the 422 patients with a new radiological stone diagnosis, 24 % had multiple stones at presentation, with 4.6% having 3 or more stones. 38 % of these stones were in the kidneys and 62 % in the ureters.

The breakdown of the stones by size and location is shown in Table 3 for all people diagnosed with renal stones (N=422) . Roughly half the stones in the kidney were 5 mm or greater in diameter, and the proportion of larger stones decreased as the stones were detected further down the ureter, with only 20% of lower ureteric stones being 5 mm or greater. This difference was statistically significant ($p<0.001$).

Table 3. Stone position by size

Stone size	Kidney N (%)	Upper ureter N (%)	Middle ureter N (%)	Lower ureter N (%)
<5 mm	87 (49%)	33 (49%)	19 (56%)	114 (80%)
5 mm & over	91 (51%)	34 (51%)	15 (44%)	29 (20%)
All participants	178 (42%)	67 (16%	34 (8%)	143 (34%)

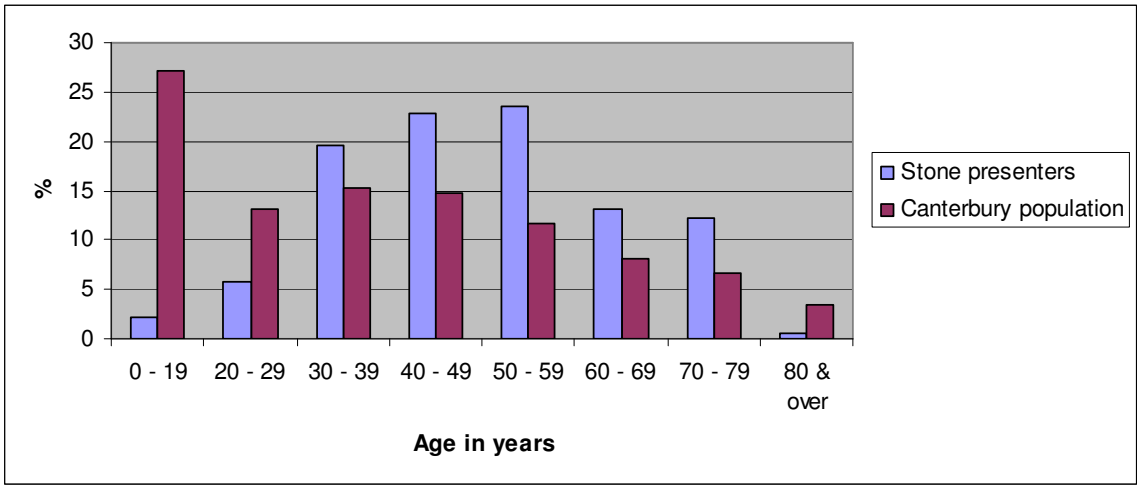
Note: Percentages may not add to 100 due to rounding; Chi-squared = 35.798, $p<0.001$, 3 df.

There were some seasonal variations in presentations although these were not statistically significant. The season with the highest number of presentations was autumn (31%), followed by winter (26%), summer (26%), and spring (17%). The season of presentation did not differ significantly by age, gender, stone size, location, or whether patients presented with pain, haematuria, or incidentally.

Of those who presented with a new stone during the study period, 70% were male and 30% were female. There was no significant difference in the mean age of men (51 years) and the mean age of women (47 years) at presentation.

Figure 1 shows that the age distribution of people presenting with renal stones is very different from that for the general Canterbury population. The majority (two-thirds) of stone presenters were aged between 30 years and 60 years. People aged less than 30 years were relatively uncommon (8%) as were people aged over 70 years (12%).

Figure 1. People presenting with new stones by age group.



Note: Age statistics for the Canterbury population were from the 2001 New Zealand census.

Ninety percent of stone presenters were of European ethnic origin. Only 3% were Māori and 1.5% were from Pacific Islands. The ethnic distribution found in this study is similar to that for the general Canterbury population, although Māori are slightly under-represented among people who were diagnosed with renal stones.

Sixty percent of patients were in paid employment and a breakdown of their occupations is shown in Figure 2. The proportion of study participants in managerial and professional work (39%) was similar to that for the general workforce in Canterbury in 2001 (Figure 2). The proportion of stone presenters in trades or machine operating jobs (27%) was comparatively larger than for the general workforce in Canterbury, which in 2001 had 18% in these occupations.

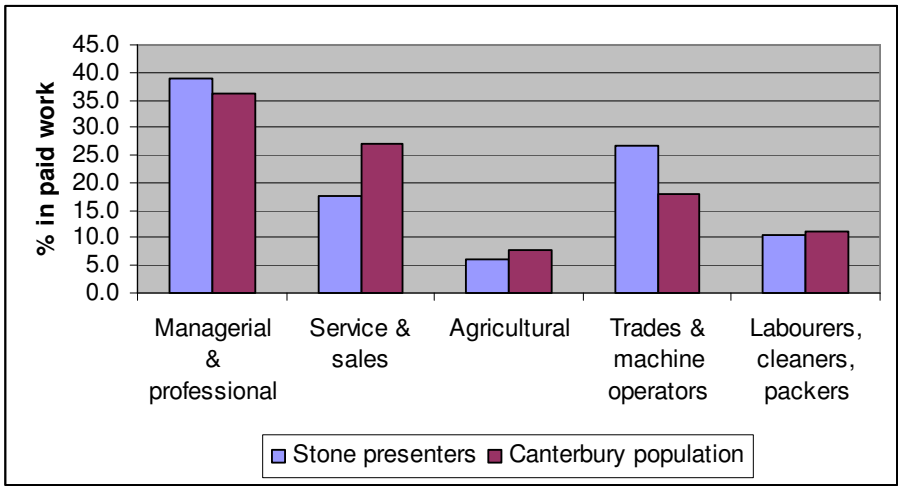
Participants in service and sales jobs (18%) were proportionally fewer than in the general Canterbury workforce (27%).

Of those patients who were not in paid employment (N=129), 19% were housewives or on the domestic purposes benefit (DPB), 9% were students, and 39% were retired or unemployed. The other 33% who were not in paid employment did not declare their reason.

Of the 327 who agreed to either participate in the study, or to make available information from their medical records, 33% had a personal history of previous renal stone disease and 20% had a family history of stone disease. There were no statistically significant differences in personal or family history by age, gender, stone position, size, or symptoms on presentation.

The vast majority (80%) of participating patients with renal and ureteric stones presented with pain; 15% were discovered incidentally, 4% with haematuria, and 1% with infection. Stone position and size influenced the presenting symptoms (Table 4); 94% of stones in the ureter presented with pain.

Figure 2. Occupations of people presenting with stones compared with the general Canterbury population of people aged 15 years and over in paid employment



Note: Canterbury population statistics obtained from the 2001 New Zealand Census.

Although 61% of stones in the kidney also presented with pain, 39% of them presented with other symptoms (p<0.001)(Table 4). Twelve out of the 13 patients presenting with painless haematuria had stones in the kidney, while 84% of the patients whose stones were discovered incidentally were in the kidney.

Table 4. Influence of stone location and size on presenting symptoms

Variables	Pain	Other (haematuria, infection, incidental)	All participants	Significance
Location				
Kidney N (%)	83 (61%)	54 (39%)	137 (100%)	Chi-squared 54.138,
Ureter N (%)	178 (94%)	12 (6%)	190 (100%)	p<0.001
Size				
<5 mm N (%)	174 (87%)	26 (13%)	200 (100%)	Chi-squared 16.495,
5 mm & over N (%)	87 (69%)	40 (32%)	127 (100%)	p<0.001

Note: percentages may not add to 100 due to rounding.

There was a statistically significant difference in presenting symptoms according to size of renal stone (p<0.001) (Table 4). While pain was the most common presentation in participants with both large and small stones, other non-painful presentations were more common in stones of 5 mm or over (32%). The majority of people with larger stones and with symptoms other than pain had their stones located in the kidney.

Discussion

Published studies have shown a clear rise in the incidence and prevalence of kidney stone disease in the Western world over the last century.[1] Current estimates of prevalence rates in European and North American countries are reported between 5% and 18.5%. Taiwan and Japan have prevalence rates of 9.8 and 10% respectively.[3,5] Incidences vary greatly with Trinchieri describing a range from 56 to 326 per 100,000 population per year.[1]

A major cause for such a range in incidences is the variation in the populations studied. Many studies measure incidence of hospitalisation or acute presentation, while others use physician or patient self reporting, or limit their study population by gender or age. All of these studies have the weakness of possibly misrepresenting the true incidence in stone disease in these communities. A strength of this present study is that all stones are radiologically confirmed, and that all radiologically confirmed stones are captured. Thus the incidence of 105 new renal stone presentations per 100,000 population per annum in the Christchurch region is likely to be an accurate estimate.

Most studies of seasonal variation in the diagnosis of renal stones show in increase in summer and autumn.[5] In stone formers, a decrease in urine volume, sodium, and pH, with correspondingly higher supersaturations of calcium oxylate and uric acid has been demonstrated during the summer months.[6] We did not find an increase in the summer months, which may be due to the large number of asymptomatic stones in this series, as the other studies have been in populations presenting with acute colic.

The ratio of men to women diagnosed with a stone was 2.3:1. This is consistent with the findings in all studies of the epidemiology of stone disease, in that a greater number of men than women are diagnosed with renal stone disease. Ratios vary from 1.4:1 in Iceland[7] to 6.3:1 in Korea.[8] There is a suggestion in the USA that the gap is closing, with Lieske and colleagues observing a change in the ratio from 3:1 to 1.3:1 over a period of 30 years in Rochester, Minnesota.[9]

Ethnicity has been shown to be relevant in an American population with the highest prevalence being in Caucasians, with Hispanics and Asians next and blacks least likely to develop renal stone disease.[10,11]

We found no difference in the incidence of stone presentation by ethnicity, but this may have been confounded by the overwhelming majority of our population being Caucasian. Anecdotally it is felt that the Māori and Polynesian populations in New Zealand have a higher incidence of stone disease. This study was not able to confirm this, and it is possible that these populations may have worse stone burden which is more difficult to treat, giving the impression of a higher incidence. Further studies in a population containing a higher number of Māori and Pacific Island peoples would be needed to clarify this further.

The finding of an over representation of trades and machine operator jobs among the stone presenters is consistent with other studies. Serio and Fraioli showed a higher prevalence in non educated than educated stone formers,[12] while hot occupations and outdoor work have also been associated with increased stone risk.[13,14]

While trade and machine operating jobs are likely to include all three noted risk factors, it is surprising that in this study stones were not also more likely in agricultural and labouring jobs, which also share these risk factors and through them an increased risk of chronic dehydration.[13]

Within our study population 20% reported a family history of stone disease, and this lies within the range of 8.1% to 31% recorded in the literature.[7,8,12,15] Stone formers have previously been observed to have a more frequent family history of stone disease than non stone formers.[16]

Although not assessed in this study, it has been suggested previously that stone disease is more common with a maternal history than paternal[3] , and when parents have stone disease when compared to siblings.[12]

Pain was the most common presenting symptom in stones of less than 5 mm diameter and in ureteric stones, which is to be expected, as small stones are more likely to enter the ureter, resulting in painful renal colic. The large number of incidentally discovered stones in the kidney reflects the radiologically diagnosed population, many of whom were clinically evaluated for reasons other than stone-related symptoms.

This study was not designed to assess other epidemiological factors previously noted to be significant in the formation of renal stones, including obesity, diet, beverage intake, geographic location, chronic disease, and stress. Neither does the study allow for multifactorial analysis of stone-forming factors.

A weakness of the study is that further epidemiological information was not able to be collected on all stone presenters, with only 66% agreeing to information on ethnicity, occupation, and salary—and 77% having data on symptoms at presentation, past medical history, and family history of stone disease. As the predominant reason for not enrolling in the trial was that the stone presenters were too busy, there could potentially be a bias in the data against working men and women.

Conclusion

Kidney stone disease is a significant health condition that affects men more than women, and people of predominantly working ages. It's incidence is increasing. There were some occupational differences in stone incidence that may be explained by lifestyle factors including dehydration. Both personal and family history of previous stone disease appears to be a significant risk factor. Pain was the most common presenting symptom, and the majority of these patients had stones located in the ureter. Renal stones presented more commonly with other symptoms, particularly haematuria

Competing interests: None known.

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Renal stone disease in Christchurch, New Zealand. Part 2: a community study on the burden of renal stone disease

Peter J Davidson, Ian G Sheerin, Chris Frampton

Abstract

Aim To quantify the annual burden of a 12-month cohort of newly diagnosed renal stones in the defined community of Christchurch, New Zealand, and to assess this burden by stone size and position.

Method In this prospective study of stone burden, patients in the Christchurch region of New Zealand with newly diagnosed renal stones maintained a weekly diary for a 12-month period to record the utilisation of health services and financial and social costs to families and partners. Patient records were matched with diagnostic and clinical information to provide a comprehensive database. The economic costs of the various services were estimated.

Results From November 2001 to November 2002, 422 newly diagnosed renal stones were detected—an annual incidence of 105 per 100,000 population. The annual mean cost of these stones was NZ$4274 per person in the first 12 months. The greatest costs were those for emergency visits, hospitalisations and for operative procedures (23.8%, 22.7%, and 21.8% of total financial burden respectively). Patient workdays lost accounted for 10.9% of total costs. Ureteric stones caused greater social burden than kidney stones. Costs were influenced by stone location and size, being significantly higher for ureteric stones and for larger stones.

Conclusions: Renal stone disease places a considerable burden on the community. The main burdens were related to health service costs, with personal and pharmaceutical costs representing only a small component. The financial burden to society is estimated at $450,000 per 100,000 population ($NZ in 2001/02).

Renal stone disease creates a burden on the community not only through the direct costs of medical care and lost income, but also through the social cost of lost opportunity. The prevalence of renal stone disease is increasing, as is the cost of looking after patients with stones.[1,2]

Approximately 15% of men and 6% of women will be diagnosed with a renal stone at some time during their lives,[2] and while some stones do not require medical intervention, the majority of people will avail themselves of medical services at some time for their stone disease.

Improved information on the societal costs of renal stone disease and a better understanding of how those costs are generated would allow for better planning of stone management. Treatment of nephrolithiasis has been demonstrated to be influenced by both the location and the size of kidney stones.[2–4] Therefore, it is important to investigate the influence of stone size and location on costs and on the need for medical intervention.

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While some studies have considered the financial burden of various stone treatments,[4,5] and others the cost-effectiveness of different interventions,[4,6,7] they generally do not provide details on non-medical stone burden. The total community burden of stone disease has not been well studied.

The burden of urolithiasis in the United States was analysed in the Urologic Diseases In America Project,[1,8] which utilised a combination of a number of large data bases to estimate medical visits, intervention rates, and both the direct medical and indirect costs for urinary stone disease. They found that the total cost of urolithiasis is increasing, despite a shift from inpatient to outpatient treatment and the development of less invasive treatments. Renal stones were also associated with substantial lost work time.

The objective of this study is to quantify the full community burden of a 12-month period of newly diagnosed renal stones. It aims to do this by identifying all newly diagnosed stones in the community and following each stone in detail over that 12-month period. Further, the study aims to quantify the burden by both stone size and position.

Methods

In this prospective study, the patient population included all patients with a radiologically confirmed new diagnosis of renal and ureteric stones in the Christchurch region between November 2001 and November 2002. Patients were eligible for enrolment if they resided in either Christchurch City or the surrounding rural areas encompassed by the Waimakariri, Hurunui, Banks Peninsula or Selwyn Districts.

The seven radiological facilities servicing this area all used the same COMRAD package for radiological reporting. A query was designed to search for the keywords “stone”, “stones”, “calculus” and “calculi”. A daily list of all X-ray reports containing these keywords were scanned by research nurses and those containing reference to calculi or stones in either the ureter or kidney were identified.

Patients were then contacted on the next business day by the research nurses and, if this was the first time the stone had been diagnosed, asked to participate in the research. Stone data collected included size, location, and multiplicity.

Those signing consent had demographic data collected which included ethnicity, occupation, salary, address, gender, and age. Further information was collected on stone presentation, family history, and past history of urolithiasis. Participants filled out a weekly diary documenting time off work for both them and their partner, lost social opportunity, extra social support, visits to outpatients, after hours services, emergency, general practitioners, specialists and “other” practitioners, admissions to hospital, procedural interventions, X-rays, tests, medications and “any other financial impact.”

Patients were followed until either the stone had passed, or been removed, or they had been on the study for 12 months and still had their stone. Patient diaries were complemented by telephone follow-up which was verified by checking medical records and telephone calls to medical practitioners.

Costs of health services were estimated using a micro-costing approach in which detailed cost estimates were made of the services utilised by patients. Costs were valued in 2001/02 New Zealand dollars. A societal perspective was assumed, in which all costs associated with renal stones were estimated, including health service costs, and costs to private individuals.

In New Zealand, the majority of hospital and specialist services are funded through a system of taxation and public hospitals. The public hospital costs of hospitalisations, emergency room visits, radiology, and laboratory investigations were valued using actual costs provided by the Decision Support Unit of the Canterbury District Health Board (CDHB), the public provider in the study area. These costings are based on a patient allocation of true costs derived from the various cost centres involved in providing care to that patient.

For those patients who received private hospital treatment, the relevant costs were the actual costs charged by the private provider. As 97% of the costs of hospital interventions were incurred in the local

non-profit public hospital, the vast majority of the costs were actual costs. So in these results, profit margins which may be included in private hospital charges were not a significant factor.

Pharmaceuticals were valued at the prices paid by the Pharmaceutical Management Agency of New Zealand. In New Zealand there are co-payments for pharmaceuticals, with the government covering the majority of the drug costs. Participants reported on the out-of-pocket costs of fees they had paid themselves for health services, pharmaceuticals, and visits to medical practitioners. The societal costs of lost production were estimated using the actual incomes of the participants, together with the reported hours of lost work.

Lost earnings for paid work of retired people, part time workers and people working from their own homes were included. Foregone social activities were also recorded for all participants, although no economic cost was assigned to them, following the recommendations of Brouwer, Rutten, Koopmanschap.[9] Similarly, no monetary value was assigned for lost leisure time or lost unpaid work as conventional recommendations are that they should be treated as aspects of quality of life, rather than as "lost production" (ibid).

Statistical analyses were conducted using SPSS (v13.0) software. Patient characteristics were compared between consenting and non-consenting patients using Chi-squared tests and independent t-test as appropriate. Outcome data, including visits, costs, and days lost were compared between stone position and stone size groups using Chi-squared and Kruskal Wallis non-parametric ANOVAs depending on the form of the outcome variable. A p value <0.05 was taken to indicate statistical significance.

Results:

422 new stones were diagnosed over 12 months in a population of 400,250, giving an incidence of 105 newly diagnosed stones per 100,000 people. 280 patients agreed to enter the study; 74 failed to complete a year of diaries. Of these 4 were lost to follow up, 70 had their diaries completed by the research nurses by phone contact with the participant and these phone contacts were backed up by review of their medical records (public hospital, private and general practitioner).

The majority of these patients stopped filling their diaries as they had no further problems from their stones over the study period. Of the 142 that did not agree to participate, 47 gave consent to access their medical records, but for the purposes of this study are considered as non-participants. The 280 patients who agreed to be in the study were slightly younger and more likely to have ureteric stones that these non-participants (Table 1)

Table 1. Comparison between those presenting with stones who participated in the study and those "not in study"

Variables	In study	Not in study	P value
Age (Mean, years)	49 (sd=14)	51 (sd=20)	0.18
Gender (% female)	30.4	34.5	0.39
Stone size (Median, mm)	3 (range: 1–50)	4 (range: 1–22)	0.40
Stone location (% kidney)	28.9	45.1	0.001
Single vs multiple stones (% single)	75.4	77.5	0.63

The total financial burden of stone disease for this cohort of 280 patients is estimated at $1.197 million (Table 2). Costs of emergency visits were the largest health service costs (23.8%), followed by those for hospital bed days (22.7%), operative procedures (21.8%), and X-rays (10.5%). Costs of lost work days also comprised 10.9% of the

total burden. Individually, the average cost of a newly diagnosed stone over a 12 month period was $4274.

Table 2. Financial burden to society of stone disease

Costs of:	Financial burden (N=280) (in $NZ)			% of total financial burden
	N	Burden	Mean cost per person	
Diagnostic tests	655	23,103	83	1.9
X-rays	896	125,540	448	10.5
Pharmaceuticals	na	5,513	20	0.5
GP visits	340	20,011	71	1.7
Emergency visits	268	284,370	1,016	23.8
Specialist visits	273	39,830	142	3.3
Hospital bed days	416	271,411	969	22.7
Operations	118	261,088	932	21.8
Non-operative procedures	28	8587	31	0.7
Work days lost	921	130,373	466	10.9
Partner work days lost	174	20,058	72	1.7
Other expenses	15	6,713	24	0.6
Total financial burden	na	1,196,597		100
Total burden per person			4274	

Notes: Costs are in 2001/02 NZ dollars. Percentages do not add to 100 because of rounding.

The social burden of stone disease was expressed in terms of missed social opportunities, missed days off work, and work days missed by the supporting partner. 39.6% of the 280 participants reported missing social events as a result of their stone disease over the study period. 53.9% of participants missed days off work and a further 27.1% of partners missed days off work.

Stone position had a significant effect on many of the indicators of stone burden (Table 3). The most common positions were the kidney (38.2%) and in the lower ureter (40.4%). Ureteric stones were more likely to result in emergency, after hours and outpatient visits ($p<0.01$). Renal stones resulted in significantly more specialist visits ($p=0.002$) and upper ureteric stones in a significantly greater number of admissions, and operative procedures ($p<0.001$).

Larger stone size was more likely to result in specialist visits in either the public hospital outpatients or in private practice (Table 4) ($p<0.001$). They were also more likely to result in admissions to hospital and procedures, both operative and nonoperative ($p<0.001$). Stone size did not have a significant influence on numbers of emergency department visits or after hours visits. Hence, stone size is a significant indicator of the utilisation of hospital admissions and surgical intervention.

Table 3. Percent reporting different types of medical contact by stone position

Variables	All stones (N=280) (%)	Kidney (N=107) (%)	Upper ureter (N=31) (%)	Middle ureter (N=29) (%)	Lower ureter (N=113) (%)	P value* (Chi-squared test)
GP Visits	55.0	52.3	54.8	62.1	55.8	0.835
Emergency visits	73.9	44.9	100	93.1	89.4	<0.001
After Hrs visits	21.8	14.0	16.1	41.4	25.7	0.010
Outpatient visits	43.6	34.6	67.7	55.2	42.5	0.010
Private specialist visits	13.6	23.4	9.7	6.9	7.1	0.002
Admissions	49.3	41.1	80.6	44.8	49.6	0.002
Operations	22.1	26.2	48.4	24.1	10.6	<0.001
Nonoperative procedures	6.4	6.5	12.9	3.4	5.3	0.419

*P value indicates statistical significance for stone position.

Table 4. Percent reporting different types of medical contact by stone size

Variables	All stones	Stone size			
	(N=280)	<5 mm (N=174) (%)	5–9 mm (N=84) (%)	>9 mm (N=22) (%)	P value* (Chi-Square test)
GP Visits	55.0	50.0	64.3	59.1	0.017
Emergency visits	73.9	80.5	65.5	54.5	0.467
After hours visits	21.8	24.1	20.2	9.1	0.336
Outpatient visits	43.6	35.1	56.0	63.6	<0.001
Private specialist visits	13.6	7.5	22.6	27.3	<0.001
Admissions	49.6	42.5	57.1	77.3	<0.001
Operations	22.1	7.5	38.1	77.3	<0.001
Nonoperative procedures	6.4	3.4	8.3	22.7	<0.001

*P value indicates statistical significance for stone size groups (<5 mm, 5–9 mm, and >9 mm).

The burden to society as valued by total costs per person was significantly greater for patients with ureteric stones (Table 5; significant at p<0.001). Ureteric stones were also associated with significantly higher mean per patient costs of operative procedures, bed days, emergency visits (p<0.001), outpatient visits (p=0.01), X-rays, and lost work days (p<0.05). There was no significant difference for drug costs.

Costs per person also tended to be significantly higher for people with larger stones (Table 6). Mean costs per person were significantly greater in larger stones for total costs, costs of procedures, outpatient visits (p<0.001), X-rays, and drugs (p<0.01).

Stone size did not significantly affect mean costs for emergency visits or lost work days.

Table 5. Types of costs ($NZ per person) of stone disease by stone position

Types of costs (per person)	All participants (N= 280) mean (range)	Kidney (N=107) mean	Upper ureter (N=31) mean	Middle ureter (N=29) mean	Lower ureter (N=113) mean	P value* (Kruskal-Wallis test)
Total burden	4274 (84–3,241)	4142	8152	4044	3393	<0.001
Procedure cost	932 (0–18,902)	1386	1874	739	294	<0.001
Bed day cost	969 (0–18,664)	762	2872	836	678	<0.001
ED cost	998 (0–5,635)	648	1582	1152	1130	<0.001
X-ray cost	448 (52 –1,478)	430	577	457	428	0.018
Cost work days lost	466 (0–5,615)	458	603	403	451	0.046
Drugs cost	20 (0–174)	23	23	20	15	0.467
Outpatient cost	119 (0–432)	101	185	149	110	0.010

*P value indicates statistical significance for stone position (in kidney, upper, middle, or lower ureter).

Table 6. Types of costs ($NZ per person) of stone disease by stone size

Types of costs (per person):	All participants (N=280) mean cost & (range)	<5 mm (N=174)	5–9mm (N=84)	>9 mm (N=22)	P value* (Kruskal-Wallis test)
Total burden	4274 (84–33,241)	3000	5485	9719	<0.001
Procedure cost	932 (0–18,902)	219	1446	4613	<0.001
Bed day cost	969 (0–18,664)	623	1469	1798	0.008
ED cost	998 (0–5,635)	995	1023	934	0.284
X-ray cost	448 (52–1,478)	403	485	667	0.002
Cost work days lost	466 (0–15,615)	407	498	811	0.481
Drugs cost	20 (0–174)	14	27	36	0 .002
Outpatient cost	119 (0–432)	93	153	192	<0.001

*P value indicates statistical significance for stone size.

The relative costs of stones in an individual (considering stone location and size) are shown in Table 7. Large upper ureteric stones were the most expensive and small renal stones the lowest cost.

Table 7. Mean costs ($NZ per person) of stones by their size and location

Location	<5 mm $ mean cost	5 to 9 mm $ mean cost	>9 mm $ mean cost
Kidney	2312	4033	9577
Upper ureter	5277	9783	10658
Mid ureter	2580	6247	8384
Lower ureter	3138	4833	No stones

Note: Differences were statistically significant at p<0.01, using analysis of variance.

Social burden was also assessed according to stone position and size. The percentage of participants who missed days of work was significantly related to stone position (Table 8). People with stones in the lower ureter reported lost work days more frequently, but individuals with upper ureteric stones tended to lose more days off

work for each stone, thus costing more for lost work days. Days of work missed by supporting partners were reported in 27% of cases, and this was also significantly related to stone position.

Table 8. Percent reporting types of social burden by stone position

Variables	All stones	Stone position				P-value* (Chi-squared test)
	(N=280) (%)	Kidney N=107) (%)	Upper ureter (N=31) (%)	Middle ureter (N=29) (%)	Lower ureter (N=113) (%)	
Missed social event	39.6	35.5	39.7	34.5	45.1	0.693
Missed days of work	53.9	45.8	64.5	48.3	60.2	0.044
Partner support missed days	27.1	15.0	41.9	10.3	38.9	<0.001

*P value indicates statistical significance for stone position.

Missed social events were also reported by 39.6%. These types of social burden did not vary significantly by stone size (Table 9).

Table 9. Percent reporting types of social burden by stone size

Variables	All stones	Stone size			P value* (Chi-squared test)
	(N=280)	<5 mm (N=174) (%)	5–9 mm (N=84) (%)	>9 mm (N=22) (%)	
Missed social event	39.6	37.4	40.5	54.5	0.220
Missed days of work	53.9	55.7	47.6	63.6	0.304
Partner support missed days	27.1	26.4	29.8	22.7	0.744

*P value indicates statistical significance for stone size.

The potential confounding influence of gender and age were investigated. Analysis of the data found that both stone size and position were important for all patients and the results did not vary significantly by age or gender.

Discussion

It is difficult to compare health costs between countries. Parker et al showed that in the USA the cost of stone treatment by ESWL was greater than by ureteroscopy.[4] In Taiwan, Ying-Huej Lee et al showed the opposite, with ureteroscopic treatment costing more.[10]

Lotan et al showed that not only did the ratios of cost between these two treatments differ between the countries studied, but the total costs for each procedure varied greatly between countries, as did the cost of stone prevention.[11]

Such variation is a product of not just variations in prevalence, incidence and outcomes of treatment, but more importantly is highly sensitive to the differing cost

drivers in the various countries. Therefore it is important for each country to assess the costs associated with diseases such as renal stone disease in their own country.

This study accurately defines the burden of renal stone disease in a New Zealand community of 400,250 people An incidence was documented of 105 newly diagnosed stones per 100,000 population.

280 out of 422 people with newly diagnosed stones consented to participate in this study If it is assumed that the costs were similar for non-participants, then the total annual financial burden in this community of kidney stone disease would be NZ$1.804 million, or NZ$450,000 per 100,000 people. If this were to be extrapolated to the whole New Zealand population, then it could be assumed that the financial burden of renal stone disease would be greater than 18 million dollars in 2002.

There have been many different ways of trying to estimate the financial burden of renal stone disease. The simplest approach is to simply assess the direct costs of equipment and consumables for a particular procedure.[12] This neglects the real costs of bed days, theatre time and the other costs associated with any particular treatment. Others have included these costs, but only as regards different treatment options.[4,10]

This approach does not cost non-treated stones. Other studies have tried to approach the costing of renal stone disease by complex decision analysis models[11], which require the use of a number of assumptions. These assumptions are at risk of inaccuracies, which can compound through such a model, resulting in a flawed outcome.

The most comprehensive attempts to define the community financial burden of stone disease are the studies of Saigal et al[8] and Pearle et al. [1] They attempt to define the burden of stone disease by extrapolating down from large community based databases, which give a good indication of overall cost, but have little ability to assess the detail of the cost drivers. The approach taken in the current study is unique in that it defines the burden of renal stone disease by building up actual costs of each new stone diagnosed, in both a defined and captive community.

In this study, only 280 out of the potential study population of 422 consented to be involved. Therefore a potential weakness of this approach could be that the costs might be different between those that consented to be on the study when compared with those that did not. The only significant difference between the two groups was that there were proportionately fewer kidney stones in the study group, and as these stones were less expensive, there could potentially be a slight over representation of the financial burden for the whole group.

Of those not consenting to participate in the study, the overwhelming reasons for withholding consent were that they were either “too busy” or “couldn’t be bothered”. It is possible that this group would have a higher percentage of working men and women, thus causing a possible under representation of the cost of lost work days and overall financial burden in the study population. Any differences in overall and individual financial burden are likely to be small, and the relative costs by stone position and size are unlikely to be substantially altered as a result of the non participants.

A further potential weakness of the approach used in this study is that of the onus on the study participant to identify all events and costs associated with their stones. As each patient was phoned weekly to confirm the events on the diary (and to enquire about events in the 70 participants who ceased filling out their weekly diary themselves), this is unlikely. Furthermore, cross correlation with GP and hospital records minimised erroneous reporting, thus making this an unlikely source of error.

In a US study, stone size has previously not been shown to have an impact on cost[4], when stones were divided between those less than and those greater than 1 cm. This study by Parker et al, however only compared the cost of stone treatment by either ureteroscopy or ESWL. In the current study, all costs associated with the stone are included, which explains the finding of a significant difference in financial burden by stone size. In addition, the position of a stone has a significant financial and social impact.

Large stones in the upper ureter are the most expensive at $10,658 per stone. When the drivers of this cost are explored, it is found that these stones have recurrent emergency visits and admissions and most eventually end up with a surgical removal. Stones located in the ureter are often painful and therefore more likely to require surgical intervention.

Data such as this can allow for the modification of stone management such that these stones are dealt with as expeditiously as possible, to avoid these recurrent presentation to health services. Furthermore, the cost data detail presented in this study can form the basis for the design of future randomised trials of differing stone management strategies.

In addition to the importance of stone size and position, this study shows that the main burden of costs are health service costs, particularly those of emergency department visits, hospitalisations and medical procedures.

Costs falling on private individuals were a relatively small percentage of the overall burden, but were still significant at approximately 13% of the total burden. The costs of diagnostic investigations were also important, comprising approximately 12% of total costs. Perhaps surprisingly, the costs of pharmaceuticals were relatively low at less than 1% of the total burden.

This study also looks at the social burdens of renal stone disease. While there is a financial burden, there is also a social burden to patients and their families. Saigel et al[8] found that one third of their patients missed work due to their kidney stones. Over half of our patients (53.9%) missed between them a total of 921 days and 27.1% of their partners missed a total of 174 days of work.

Thus in a 12-month period there were 1095 days of lost productivity. Ureteric stones were more likely to cause this lost productivity. The authors had anticipated that stones would cause considerable social disruption in terms of lost social events, as these stones are often extremely painful. Surprisingly, only 39.6% missed social events and this was independent of both stone size and location.

As this percentage is less than the percentage missing days of work, it could be concluded that either participants were more reluctant to miss social events, or alternatively there were fewer opportunities to miss social events than work days.

Conclusion

The annual incidence of newly diagnosed renal stones was 105 per 100,000 population. A total annual financial burden of kidney stone disease in this community was estimated to be NZ$1.804 million, or NZ$450,000 per 100,000 people. The greatest costs were those of emergency department visits, hospital bed days and operative procedures.

Costs varied significantly with the main influences being stone location and stone size. Larger stones and those located in the upper ureter were associated with significantly higher costs.

Competing interests: None known.

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Not in my hospital? Ethnic disparities in quality of hospital care in New Zealand: a narrative review of the evidence

Juliet M L Rumball-Smith

Abstract

There are well-documented differences in health outcomes between Māori and New Zealand Europeans, some of which persist despite adjustment or control for socioeconomic status and demographic variables. Lalonde defined the health system as being a determinant of health: is it possible that the services that are designed to improve health and well-being may be contributing to the ethnic health disparities in New Zealand?

This narrative review studied the evidence for disparities in the quality of public hospital care for Māori and non-Māori in New Zealand. Medline and Embase databases were employed to identify studies assessing quality of care within the New Zealand hospital setting, with the analysis of ethnic groups. The studies obtained from the search were few and varied, using an array of indicators and assessing multiple discrete clinical conditions. Investigators also exhibited differing levels of commitment to the consideration of potential confounding factors. However, there is robust evidence for the existence of healthcare disparities for Maori, in particular related to obstetric intervention and the incidence of potentially avoidable adverse events.

At the 2006 Census, 67.6% of the New Zealand population self-identified as a member of the New Zealand European ethnic group, the second largest ethnicity being NZ Māori (14.6%, total Māori ethnic group).[1] However as of 2000–2002, NZ Māori men could expect to live on average 8 years less than a non-Māori male.[2]

At all levels of deprivation, NZ Māori experience greater rates of mortality than non-Māori, and a greater reduction in life expectancy.[3,4] Socioeconomic variables contribute to these health outcomes inequalities, but are only one consideration when investigating health differences between ethnic groups. Inequalities are noted to persist after epidemiological control for these variables; this phenomenon has been termed the 'outcome gap'.[5]

Why does this gap occur? Lalonde developed the Health Field Concept to describe the broad and varied determinants of health.[6] Health status was conceptualised as the result of a complex interplay between the biological characteristics of the individual, lifestyle factors, the wider environment (including socioeconomic factors), and the structure and actions of the health system.

It is possible that the health disparities between NZ Māori and NZ Europeans may be contributed to by health services, including the actions of those who work within it.[7] There is substantial evidence regarding health care disparities in other countries, and despite differences in cultural and historical context, it is useful it is useful to look at the findings of this international research.

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The United States (US) has multiple minority populations, totalling more than 100 million. There is a multitude of published studies documenting 'racial' disparities in the quality of care in the US, including several systematic reviews. The largest of the meta-analyses is *Unequal Treatment*, a document produced by the Institute of Medicine at the behest of US Congress, encompassing the review of more than 600 articles. The Institute focussed on studies in which factors that impacted on the patients' financial ability to access treatment were controlled, potential confounding variables were considered, and were those that compared the appropriateness of services against established clinical guidelines.

The Institute concluded in its report that health disparities according to race were 'remarkably consistent across a range of illness and health care services' (p5). Although the investigators found evidence for ethnic disparities in the receipt of quality care for numerous conditions, the most significant evidence was demonstrated in cardiovascular and cancer care, and in the care of patients with human immunodeficiency virus.[8]

The evidence for disparities in the quality of care in the US is so firmly established that the *National HealthCare Disparity* report is produced annually to provide information regarding the progress of the health system in providing equitable care to minorities.

There is a large amount of information available regarding differences in health care use for NZ Māori as compared to non-Māori; for example, NZ Māori have lower rates of access to some elective surgical procedures, including angioplasty and major joint replacements.[9] However, do these differences represent health care disparities?

Rathore and Krumholz propose five formal criteria against which to assess racial differences, in order to ascertain if they may be classified as 'disparities':[10]

- Eligibility of patients for intervention.
- Accounting of potential contraindications to intervention (e.g. comorbidities).
- Consideration of patient preferences.
- Robust risk adjustment of patient factors, including demographic, clinical, and social variables.
- Association with poorer patient outcomes.

They summarise these concepts in their definition of disparity, stating that 'a disparity in health care use may be considered a difference in *appropriate* treatment use that is associated with *poorer* clinical outcomes and is not attributable to *patient factors*' (p636). This statement clearly relates health care inequality with health outcomes, and emphasises the need to control for possible confounding and mediating factors. While their criteria must be considered with caution (is differential treatment for those of differing socioeconomic position acceptable?), the definition provides a useful framework against which evidence may be assessed.

Considering the information above, it is theoretically possible that NZ Māori actually receive the appropriate level of elective surgical input, and non-Māori may over-use these services. Therefore, the differences in care use represent disparities only if it can be demonstrated that the level of care is inappropriate to the level of need, and that

health and well-being suffer as a consequence. Similarly, rates of use do not consider the impact of patient factors; such as patient preference, severity of illness, or impact of comorbidities on eligibility criteria.

This study aimed to review the evidence for disparities in the quality of care received by NZ Māori within New Zealand. It is focussed on the quality of care received at public hospitals, which is provided at no financial charge to all New Zealand residents.

Methods

A literature review was conducted of Ovid databases Medline (1950–2008 week 32) and Embase (1947–2008 week 32) using the following search terms: ethnic$ or ethnicity, race$ or racial$, quality of health care/, Māori, New Zealand, health status disparities/, minority groups/, cross-cultural comparisons/.

This initial combination yielded only 49 studies. Subsequently, the search was expanded to the combination of two separate searches involving only two search terms each, quality of health care/ or ethnic differences/ in combination with (New Zealand or Māori). New Zealand researchers were also contacted to obtain unpublished 'grey literature' pertaining to this topic. After applying limits regarding English language, human, and availability of abstract, this strategy revealed 266 distinct publications. Studies were reviewed if they involved the assessment of the quality of inpatient care, were set within the publicly-funded hospital environment, and involved comparative analysis according to ethnicity.

The methodology of each study was assessed; reviewing its design, data sources, study and comparison population, choice of indicators, and consideration of potential confounders and sources of bias. Two criteria were applied to ascertain whether findings from each study were indicative of a healthcare 'difference' or a 'disparity. These criteria were borrowed from the definition advanced by Rathore and Krumholz,[10] as detailed above. That is, were the findings of the studies examined that demonstrated healthcare quality differences:

- Associated with poorer outcomes?
- Persistent after consideration for patient variables?

Results

Studies that employed quality indicators that were specific to inpatient care were few; totalling 11 only. These documents were varied, both in the indicators employed, and in the clinical conditions examined. Accordingly, it was not possible to conduct a formal systematic review, in which the studies' findings could be collated and quantitatively synthesised. A narrative approach was considered to be more appropriate, being able to encompass the diversity of the investigations and provide qualitative conclusions.

The 11 studies varied in quality, some considering the impact of multiple confounding factors, as well as potential statistical bias from undercounting of Māori; others performing few methodological or statistical adjustments for these factors.

The details of the investigations are noted in Table 1; and described further below, grouped according to clinical condition:

Table 1. Articles reviewed regarding the quality of inpatient hospital care for Maori in New Zealand

Quality of care indicators	Data source and sampling methodology	Māori participants and reference group	Control/adjustment for other variables	Findings	Notes
Process of care indicator for obstetric care: Rates of caesarean section, instrumental delivery.	Review of Antenatal and delivery suite clinical records. Prospective cohort. Sampling unknown. Blinding unknown.	1181 Māori and 1242 European women.	Nil	Lesser proportion of Māori women undergo CS (6.8% compared with 11.9%, p=0.0004), instrumental delivery (4.1% compared to 13.3%, p not given). Less proportion of Māori undergo epidural analgesia (13.2% compared to 31.8%, p=0.001) (note: sample size for this analysis limited to 1 month cohort).	Middlemore Hospital, 1992/1993.[18]
Process of care indicator for obstetric care: Rates of caesarean section	Perinatal Information Management System database, Capital and Coast DHB. Retrospective study.	59 Māori and 557 non-Māori non-Pacific women.	Sample limited to nulliparous women gestation ≥36 weeks.	No 'statistically significant difference' in rates of CS.	Wellington Hospital, 2001.[19]
Process of care indicators for obstetric care: Induction of labour, prelabour caesarean section, post-labour caesarean section, operative vaginal delivery.	Obstetric database of National Women's Hospital, Auckland. Retrospective study.	4361 Māori and 30,809 non-Māori non-Pacific women.	Adjustment performed for age, parity, small for gestational age, antepartum haemorrhage, gestation and birthweight at delivery, maternal diabetes, maternal hypertensive disease, transfer of care gestation at booking, booking caregiver. Sample limited to women with singleton deliveries, cephalic presentation, no previous CS.	Māori women less likely to undergo: Induction of labour (OR 0.85, 95% CI 0.78–0.93), Prelabour CS (OR 0.57, 95% CI 0.43–0.75), Operative vaginal delivery (OR 0.71, 95% CI 0.63–0.81). No significant difference in post-labour CS rate (OR 0.93, 95% CI 0.82–1.06).	National Women's Hospital, 1992–1997.[20]

Quality of care indicators	Data source and sampling methodology	Māori participants and reference group	Control/adjustment for other variables	Findings	Notes
Process of care indicator for obstetric care: Rates of caesarean section	New Zealand Health Information Service. Retrospective study.	51,106 Māori and 192,401 non-Māori delivering at public and private hospitals.	'Ever Māori' classification to minimise undercounting of Māori. Modelling included consideration of age, DHB, parity, fetal presentation, deprivation (using NZDep96 deciles), gestation at delivery, multiple births, maternal hypertension, maternal diabetes, antepartum haemorrhage.	All non-Māori more likely to undergo: Acute CS (OR 1.38, 95% CI 1.33–1.43), Elective CS (OR 1.44, 95% CI 1.36–1.52), Any CS (OR 1.43, 95% CI 1.39–1.48) than Māori (age and deprivation adjusted). Nulliparous non-Māori (no previous CS) more likely than to undergo: Acute CS (OR 1.13, 95% CI 1.06–1.19), Elective CS (OR 1.36, 95% CI 1.18–1.56), Any CS (OR 1.16, 95% CI 1.10–1.23) (model includes adjustment for age, deprivation, clinical factors and DHB).	New Zealand public and private hospitals, 1997–2001.[21]
Preventable adverse events	Review of hospital clinical records. Stratified cluster sampling across thirteen hospitals. Retrospective study.	1013 Māori and 5326 non-Māori non-Pacific inpatients.	Consideration of age, deprivation (using NZDep96 deciles), admission type (acute status), length of stay, hospitals, sex.	Māori had a greater risk of an in-hospital preventable adverse event (OR 1.47, p 0.05).	New Zealand public hospitals, 1998.[23]

Quality of care indicators	Data source and sampling methodology	Māori participants and reference group	Control/adjustment for other variables	Findings	Notes
Process of care indicator for cardiac care: Rate of CABG and PTCA	National Minimum Data Set, New Zealand Health Information Service. Retrospective study.	839 Māori and 26,167 non-Māori non-Pacific patients aged 40 years and over admitted for CABG and PTCA interventions.	Age-standardisation.	Māori noted to have higher age-standardised mortality rates from coronary artery disease. Māori less likely to undergo a CABG (20.5 compared to 51.2 per 100,000) or PTCA (13.9 compared to 48.1 per 100,000). Significance testing not documented.	New Zealand public and private hospitals, 1990–1999.[25]
Process of care indicator for cardiac care: Rate of CABG and PTCA	National Minimum Data Set, New Zealand Health Information Service. Retrospective study.	8456 Māori and 31,713 non-Māori admitted to public hospitals with a cardiac or heart failure DRG.	Consideration of age, sex, deprivation (using NZDep96 deciles).	Māori had a greater risk of admission for heart failure ('four or more times higher'), yet were 'one third to a half' less likely to have undergone a CABG or transvascular percutaneous cardiac procedure. Significance testing not documented.	New Zealand public hospitals, 1996–2000. [24]
Process of care indicators for ESRD: Renal transplant waiting list.	Australia and New Zealand Dialysis and Transplant Registry. Retrospective study.	935 Māori and 12,984 'non-aboriginal' (non-Māori non-Pacific non-Australian aboriginal non-Torres Strait Islander) patients with ESRD, first treated at a public hospital within study period.	Stratification and age/sex adjustment performed, however OR for Māori provided did not included adjusted ratios.	Greater incidence of ESRD noted in Māori. Lesser proportion of Māori listed on renal transplant list (34% compared to 59%, $p<0.0001$). Adjusted odds ratio after stratification and age/sex adjustment not given. Māori were more likely to receive poorer-matched grafts (OR 0.25, 95% CI 0.09–0.70). Adjusted odds ratio not given.	New Zealand public hospitals, 1991–2000.[26]

Quality of care indicators	Data source and sampling methodology	Māori participants and reference group	Control/adjustment for other variables	Findings	Notes
Process of care indicators for ESRD: Confirmation of diagnosis	Australia and New Zealand Dialysis and Transplant Registry. Retrospective study.	421 Māori and 1787 non-Māori non-Pacific New Zealand patients with ESRD, first treated at a public hospital within study period.	Age and sex standardised.	Higher incidence and mortality rates noted in Māori. Māori with glomerulonephritis less likely to have histological confirmation of clinical condition (39% unidentified type compared with 22% non-Māori non-Pacific, rate not calculated due to small numbers).	1992–2001, national public hospitals.[27]
Surgical outcome: Post-tympanostomy tube insertion morbidity.	Data obtained from surgical notes. Prospective study. Sampling of consecutive admissions. Blinding unknown.	26 Māori, 54 'Caucasian' children.	Univariate analysis noted ethnicity associated with outcomes, in addition to age and clinical factors.	Māori had a greater risk of having a non-functioning tube postoperatively (p=0.04). However, ethnicity not noted as significant factor for presence of blocked tube postoperatively on logistic regression analysis.	South Auckland Health, 2001.[28]
Process of care indicators for mental health: Use of seclusion/restraint, psychotropic medication, use of Mental Health Act, referral for psychotherapy	Data obtained from review of clinical records. Sampling of 300 consecutive inpatient admissions. Retrospective study.	125 Māori and 175 non-Māori mental health inpatients.	Consideration of age, sex, diagnosis, number of readmissions, time of onset between illness episode and admission.	Māori less likely to be referred for psychotherapy (OR 0.1695, 95% CI 0.07–0.35), more likely to receive antipsychotic medication (OR 1.90, 95% CI 1.11–3.25), and at higher doses. No evidence of an association between ethnicity and readmission rates, use of seclusion or compulsory admission.	2000–2001, Rotorua Hospital.[29]

ESRD = End-Stage Renal Disease, CABG = Coronary Artery Bypass Graft, PTCA = Percutaneous Transluminal Coronary Angioplasty, DRG = Diagnosis related Group, DHB = District Health Board, CS = Caesarean Section, NZDep96 = New Zealand Deprivation Index 1996, CI = Confidence Interval, OR = Odds Ratio.

Obstetric intervention

Studies—Four of the 11 studies considered outcomes related to obstetric intervention. Ministry of Health documents note that Māori undergo lower rates of these procedures than non-Māori;[11–15] yet it has been suggested that Māori may experience higher risk pregnancies than non-Māori.[11] Certainly, there is evidence of greater rates of maternal diabetes and smoking during pregnancy in Māori,[16,17] both factors associated with a higher risk of clinical intervention.

Johnson et al noted lower rates of caesarean section (CS) and instrumental delivery in their cohort of Māori women at Middlemore Hospital, yet these findings did not consider any potential confounding factors, including age and parity.[18]

Sangalli and Guidera limited their population to nulliparous women at term, and described no significant ethnic difference in the rate of CS in their small sample (59 Māori women only) at Wellington Hospital, although also performed minimal adjustment for other variables. [19]

Sadler et al used information from a National Women's Hospital (NHW) database, 1992–1997. The study population was limited to women without previous CS, who delivered a singleton following cephalic presentation at NWH during the study period.[20] Factors included in the modelling were age, parity, obstetric risk factors, transfer of care, booking caregiver, and an indication of the chronicity of their antenatal care using gestation at booking.

After adjustment for these variables, the Māori women were significantly less likely to undergo induction of labour, pre-labour CS, and operative vaginal delivery. The researchers note that the lower rates of epidural analgesia may contribute to the lower rate of operative vaginal delivery in Māori women (this factor was not included in the multivariate analysis). However, the differences in rates described—despite control for a significant number of possible variables- indicate that Māori in this sample may have received disparate treatment.

Harris et al reviewed CS rates nationally, and noted similar results. This team of researchers used the national hospital database to identify women delivering by CS at public and private hospitals 1997–2001.[21] They used the 'Ever Māori' classification technique to minimise under-counting of Māori, and obtained data regarding fetal presentation, gestation at delivery, multiple births, maternal hypertension, diabetes, and antepartum haemorrhage.

These clinical factors were included in the modelling, as were deprivation (using NZDep96 deciles), age, DHB, and parity. Of nulliparous women without previous CS, non-Māori were more likely to undergo acute, elective, and any type of CS (all significant results). Similar significant odds ratios were demonstrated in women regardless of parity.

Ethnic variation in obstetric intervention: difference or disparity?—Obstetric and perinatal outcomes are known to be poorer for Māori women and their babies compared to NZ European patients.[22] The studies by Sadler et al. and Harris et al. provide evidence of ethnic health care disparities. Although the differences in interventions are not directly linked to these health outcomes (and it is possible that CS is 'over-employed' in non-Maori women), their analyses consider the rate of

services delivered in comparison to clinical need. The two research teams also considered the impact of a large number of demographic and clinical variables in the sampling strategies and statistical techniques employed.

Preventable adverse events

Study—Davis et al conducted a cross-sectional examination of the records of a stratified sample (according to location and hospital type) of 6579 hospital patients across thirteen hospitals throughout New Zealand.[23] Records of all patients admitted in the year 1998 were examined, excluding psychiatric, rehabilitation-only, and day case admissions. Trained nurses examined the clinical notes initially, to identify the occurrence if Adverse Events (AE), defined as the 'unintended injury that resulted in disability, with any evidence of causation by health-care management rather than the underlying disease' (p1921).

Records in which an AE occurred were then subsequently examined by medical practitioners, in order to confirm the AE and form a judgment regarding its preventability; that is, to identify if there was evidence of failure to follow accepted practice at a system or individual level.

After controlling or adjusting for age, deprivation, admission type, length-of-stay, and sex, the researchers noted that the incidence of in-hospital preventable AE for Māori was nearly 50% greater than in the non-Māori non-Pacific sample (adjusted odds ratio 1.47).

This study used the 'gold-standard' of chart review to ascertain the quality of care; however patients may still receive poor quality of care that does not result in an AE. This lack of sensitivity is common to many quality indicators, and requires consideration when interpreting results. The study did not account for misclassification of Māori, however numerator-denominator bias is unlikely to have a significant impact given the comparisons were made internally within the cohort. However, this study did not consider the impact of clinical factors such as severity of illness, clinical condition, and comorbidities on the occurrence of AE; control of these variables may assist in assessing the distinction between an ethnic healthcare 'difference' and 'disparity' in this context.

Ethnic variation in preventable adverse events: difference or disparity?—The indicator used in this study is in itself adverse health outcome, fulfilling one aspect of the definition by Rathore and Krumholz. Although some patient variables were considered in the statistical analyses, adjustment for clinical factors may assist in further clarifying the association between ethnicity and incidence of preventable adverse events. However, even without such information, this study provided some evidence for ethnic disparity in the incidence of this indicator within the hospital setting.

Rate of cardiac interventions

Studies—Two studies assessed the comparative rates of coronary artery bypass graft (CABG) and percutaneous transluminal cardiac angioplasty (PTCA) interventions at hospitals in New Zealand, both employing the National Minimum Data Set.

Westbrooke et al compared the hospitalisation rates for Māori with their rates of intervention 1996–2000), and noted a discrepancy between apparent clinical need (demonstrated by excess hospitalisation) and their access to these interventions.[24]

The researchers adjusted or controlled for age, sex, and deprivation, but did not include clinical variables such as comorbid conditions. The results of statistical analyses were not quoted in this paper; as such it is not possible to draw conclusions regarding the statistical significance of the findings. However, it is probable that given the large sample size (more than 40,000), it is unlikely that differences of the magnitudes quoted would be due to chance.

Tukuitonga et al similarly reviewed the rates of these cardiac interventions performed at public and private hospitals 1990–1999.[25] They noted that age-adjusted intervention rates for CABG and PTCA for Māori men and women were considerably lower than those for non-Māori.

The study compared these rates with that of age-standardised mortality rates for coronary artery disease, and graphically demonstrated the difference in the perceived clinical need of Māori compared to their receipt of these interventions. Although the analyses did not control for other demographic or clinical factors, the differences between the two groups were so large that it is unlikely that consideration for these variables would have significantly altered the observed association with ethnicity. This study provides an indication of possible inequities in the delivery of these interventions, although it is possible that other factors may play a role in the apparent inverse care of Māori in this respect.

Ethnic variation in cardiac intervention: difference or disparity?—These studies attempted to link health outcomes with utilisation of services by comparing clinical need (using hospitalisation and mortality rates) with access to intervention. After applying the criteria of Rathore and Krumholz, the findings of the studies are indicative (but not conclusive) of ethnic health care disparities in the rates of cardiac interventions.

Treatment for end-stage renal disease

Studies—Two studies used information from the Australia and New Zealand Dialysis and Transplant Registry, assessing the records of patients first treated for End-Stage Renal Disease (ESRD) at a public hospital in Australia and New Zealand, to examine processes of care for these patients.

McDonald and Russ assessed the records of those treated during 1991–2000, noting the difference in the incidence of ESRD between Māori and the non-indigenous population (New Zealand non-Māori non-Pacific and Australian non-Aboriginal or Torres Strait Islander).[26]

The authors noted that Māori were statistically significantly less likely to be listed on the renal transplant waiting list than the non-indigenous group, a difference that persisted after stratification for age and sex although the adjusted ratios were not detailed. Indigenous people were also less likely to receive a graft once accepted for transplantation, although the OR calculated (0.35, 95% CI 0.29–0.43) also included Pacific Islanders, Torres Strait Islanders, and Australian Aboriginals.

It is possible that genetic factors may play a role in the receipt of transplants, as they also provided evidence of 'poorer matched' grafts for the indigenous population. That is, sheer numerical factors make it harder to find a donor for minority group patients. Factors such as socioeconomic status, clinical severity and condition, and geographical location were not included in the analysis.

Stewart et al selected 421 Māori patients and 1787 non-Māori non-Pacific New Zealanders from the same register, noting a higher incidence and mortality from the disease in the Māori group.[27] While the authors noted that Māori with glomerulonephritis were less likely to have undergone histological examination of their kidneys, the differences in the proportions noted were not subject to statistical testing, nor controlled for factors other than age and sex.

However, the differences described are reminiscent of the findings of Robson et al, who noted that Māori with cancer were less likely to have staging information recorded on registration documents than non-Māori. It is possible that these process indicators reflect disparities in the care for Māori within hospitals.

Ethnic variation in the processes of care for patients with ESRD: Difference or disparity?—It is possible that the differences in these process indicators reflect disparities in the care for Māori within hospitals. However, the indicators used are not linked to health outcomes (although they were compared with incidence of ESRD), and there was limited control or consideration of other variables in the two studies. As such, these investigations describe ethnic health care differences, but do not provide conclusive evidence of disparities in the quality of care for Māori.

Outcomes post-tympanostomy tube insertion

Study—Allen et al reviewed postoperative morbidity for Māori and non-Māori children who underwent tympanostomy tube insertion over three months in 2001.[28] Although they noted that Māori were at greater risk of having a non-functioning tube post-operatively, ethnicity was not assessed as an independent variable with other factors of influence controlled.

Ethnic variation in quality of tympanostomy tube insertion: difference or disparity?—This study demonstrates the use of surgical health outcomes as indicators of the quality of care. However it is possible that the small sample sizes involved (26 Māori, 54 Caucasian), and the impact of unaccounted for clinical factors (such as ear condition at time of surgery) and patient factors (such as compliance with medication postoperatively and socioeconomic status) limit the interpretation of the results of this investigation. As such, this study describes differences in outcomes following this procedure within the study sample, but cannot provide robust evidence of health care disparities for different ethnic groups.

Restrictive care practices

Study—Kumar et al reviewed the care of 125 Māori and 175 non-Māori mental health patients admitted to Rotorua Hospital, 2000–2001.[29] After adjustment for age, sex, diagnosis, number of readmissions, and time of onset between illness episode and admission, the researchers calculated odds ratios for restrictive care practices. These were defined as including the use of legislation for involuntary admissions,

readmission rates, the use of restraint and seclusion, and administration of higher doses of medication.

They noted that ethnicity was not associated with the first three practices, but discovered that Māori patients were less likely to be referred for psychotherapy, more likely to receive anti-psychotic medication, and at higher doses. Given that diagnosis was controlled for in the analysis, the authors concluded that Māori were more likely to receive anti-psychotics for 'non-psychotic diagnoses', and that they did not experience the same quality of care as non-Māori with regards to access to psychotherapy.

Ethnic variation in processes of care for patients with mental illness: difference or disparity?—The process of care indicators employed in this study are not directly linked to health outcomes, however it is logical that reduced access to psychotherapy may represent poor quality of care. However, the administration of anti-psychotics is less intuitive. While it is possible that Māori are being over-medicated, it is also possible that Māori are being appropriately treated and that non-Māori are being under-treated for mental illness in this hospital.

It would be helpful to be able to compare treatment regimes with agreed clinical guidelines or discrete health outcomes. Without this information, this study provides descriptive evidence of differences in the management of some mental health patients; however it is unknown whether these differences are disparities, and whether they represent poorer quality of care for one ethnic group.

Other

The review revealed several pieces of research that investigated the quality of care using measures that reflected several facets of the health system. Indicators such as avoidable or disease-specific mortality reflect the performance of all sectors of the health system, including public health, primary, secondary and tertiary care. The measures reflect the effectiveness and coordination of care provided over prolonged periods of time, and by multiple organisations and individuals. As such, it is not possible to directly extrapolate the results of studies using these indicators to the discrete performance of public hospitals.

However, the consistency of findings by multiple researchers in the detection of healthcare disparities using these broad indicators warrants mention. For example, studies using the following indicators have universally demonstrated disparities for Māori: disease-specific mortality,[30-33] avoidable hospitalisation,[34,35] avoidable or amenable mortality,[7,36,37] involuntary psychiatric admission, [38] and perception of unfair treatment by a health professional.[39]

The evidence for disparities in cancer outcomes and processes of care is particularly significant.[40,41] Although not assessed directly in this study, it is important to note the differences in health services received by Māori with cancer, despite statistical control for stage at diagnosis, comorbidities, and socioeconomic variables. [42]

Discussion

The intention of this review was to assess literature evidence for disparities in the quality of inpatient hospital care received by Māori. This study has its limitations,

primarily in the few available studies and the probability of publication bias. The articles discussed in this paper are varied, in most cases focussing on discrete clinical conditions, and together they employ a variety of quality indicators. As such, it is not possible to sum up their findings into one succinct conclusion. However, it is worth noting the following points:

- The quantity of evidence in this area is minimal in comparison to the exhaustive number of New Zealand studies describing disparities in health outcomes for Māori.
- It was not always possible to adequately assess if health care 'differences' were in fact 'disparities'. Some research teams performed admirable statistical manipulation (such as Sadler et al. and Harris et al.), but in other studies it was difficult to interpret the findings without knowing the impact of other variables. However, as Mayberry et al. state 'the methodological inadequacy of an individual study may be a relatively moot point in the context of the body of literature that gives consistent findings, and in which one study, often the more recent study, may overcome the specific failing of a previous investigation'. [43 p116]
- Despite the limitations of this review, and the points made above, the findings are relatively consistent. Each study noted a difference in the quality of care for Māori compared with non-Māori. In the majority of these investigations, Māori received the poorer treatment according to current standards or clinical need. The evidence for disparities in obstetric intervention is particularly consistent and of high quality.

There is little information regarding the causes of potential ethnic healthcare disparities in New Zealand, although Harris et al. note that NZ Māori are more likely to perceive discrimination by health professionals than non-Māori. [39] It is likely that multiple factors contribute to healthcare disparities: The Institute of Medicine considers that the actions of the health system, the patients, and the providers themselves all have a role.[8]

New Zealand researchers are fortunate to have access to a national hospital database, which contains a vast amount of variables that can be combined in quantitative analyses. Although the quality of ethnicity information within hospital systems may be improvable, attempts at assessing the impact of healthcare disparities on the health outcomes for Māori should still be made. There may also be a role for the development and validation of Māori-specific quality indicators, as suggested by previous researchers. [44, 45]

In conclusion, there is some evidence for disparities in the quality of in-hospital care for Māori in New Zealand. As health professionals, it is important to take ownership of this evidence, and use it as a possible area for intervention, to work towards improving health outcomes for Māori.

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THE NEW ZEALAND MEDICAL JOURNAL
Journal of the New Zealand Medical Association

Radiation-induced osteonecrosis of the hips following genital-preserving surgery and chemoradiotherapy

John F Quinlan, John North, Deborah A Clarke, David P Gwynne-Jones

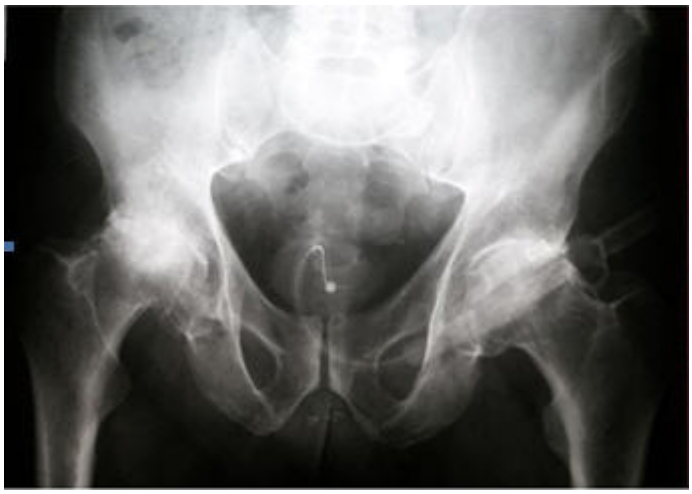
We report on the case of a 67-year-old man whose treatment for squamous cell carcinoma of the urethra has been previously published in this journal. He developed the complication of osteonecrosis requiring bilateral total hip replacements.

Case report

We previously reported the case of a 67-year-old man who successfully underwent genital preserving surgery and chemoradiotherapy for a squamous cell carcinoma of the urethra.[1] He was treated with 40 Gy/20 fractions of radiotherapy to the lower pelvis and urethra with a 10 Gy/5 fraction boost to the perineum. He also received one cycle of 5-flourouracil (1000 mg/m^2 daily × 4 days, days 1–4) and mitomycin-C (10 mg/m^2 stat day 1).

Seven months after his treatment, he complained of right hip pain which rapidly deteriorated over the following year. He required a stick to mobilise even short distances and his pain was poorly controlled with regular codeine and diclofenac as well as having constant night pain. Plain film radiographs showed significant collapse of his right femoral head with degenerative changes noted in his left femoral head (Figure 1). His Harris Hip score at the time was 21.

Figure 1. Pre-operative plain film radiograph showing collapse of the right femoral head



He proceeded to have a cemented right total hip replacement using an Exeter stem (Stryker Inc., Mahwah, NJ, USA) and a Reflection polyethylene cup (Smith &

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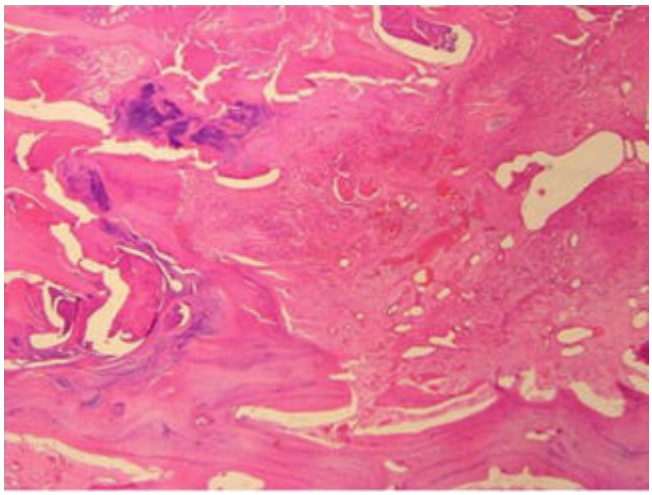
Nephew Inc., Memphis, TN, USA). Histological analysis of the femoral head confirmed osteonecrosis (Figure 2).

Figure 2. Haematoxylin and eosin (H&E) stain (20× magnification) of the right femoral head



Note: The upper left aspect of the photomicrograph demonstrates a zone of necrotic acellular bone. Adjacent to this (in the centre and upper right) is a zone of fibrosis with new vessel formation, demarcating the margins of the lesion. The lower third of the photomicrograph demonstrates new viable bone formation at the periphery of the lesion.

One year later he presented with similarly severe symptoms on the left side. Repeat plain films showed a loss of superior joint space with flattening of the femoral head. His Harris Hip score was recorded as 27. He went on to have a similar hip replacement.

At the time of reporting, the patient is 18 months following his first operation and has a Harris Hip score of 93. From an oncological viewpoint, he is disease free 40 months after the end of his treatment.

Discussion

Osteonecrosis of the hips is well described as complication of radiotherapy.[2,3] However, the literature to date consists mainly of case series and reports.[4–6] It has been postulated that the mechanism of injury is an injury to or pressure on a vessel wall.[7]

Invasive squamous cell carcinoma of the urethra is rare and is associated with a 5-year survival rate of 5–15%. Due to its rarity, this patient's therapy was based on regimens more commonly used for anal carcinoma.

Dzik-Jurasz et al[8] reported on the prevalence of femoral head osteonecrosis in such patients and found a recorded incidence of 4 out of 763 treated cases. In their own series of 34 disease free patients, no patient was found to have osteonecrosis.

However, Massin's review[5] of 71 irradiated hips following gynaecological cancers contained 17 cases (24%) of osteonecrosis.

Emami et al[9] attempted to issue guidelines in relation to potentially toxic doses of radiotherapy and suggested a tolerance limit of normal tissue of 52Gy. This supports previous work that postulates only minor changes occurring in the range of 42–45 Gy.[10]

For our patient, dosimetry showed that the maximum dose received by a small area in the femoral neck was 46 Gy, with the inferior third of the head and neck receiving 45–46 Gy and the superior two thirds of the head 40–42.5 Gy, all in 25 fractions over 5 weeks. However, it has been suggested that sensitisation of osteocytes to radiation damage may be caused by chemotherapeutic agents[4,6] little is yet known about the long-term side effects of combined chemoradiotherapy.

In summary, this case highlights the occurrence of osteonecrosis of the hip following radiochemotherapy. The reported patient however, is free from his original disease at 40 months, and pain-free following his hip surgery.

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THE NEW ZEALAND MEDICAL JOURNAL
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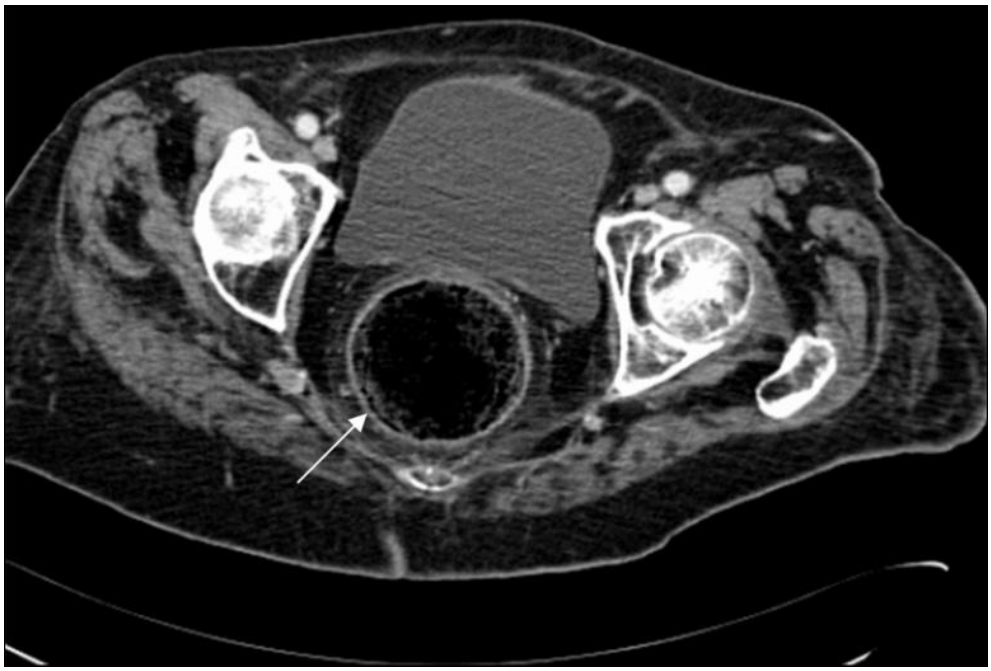
The Giotto's "O": an unusual computed tomography finding

Nicola Mumoli, Giovanni Niccoli

An otherwise healthy 90-year-old women presented to our department with a 1-day history of abdominal pain associated with nausea and vomiting. The physical examination showed a distended abdomen with decreased bowel sounds and tenderness on the left side; on digital rectal examination, hard faeces were palpable.

Figure 1. Computed tomography of the abdomen showing a Giotto's "O" (arrow)



What is represented by Giotto's O? (arrow, Figure 1)

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Answer

Computed tomography of the abdomen shows a Giotto's "O"-shaped image caused by an isolated *rectum faecaloma* (Figure 1).

After rehydration, the patient underwent manual disimpaction. Her recovery was unremarkable.

Discussion

Giotto's O is a perfectly round circle that Giotto is said to have sent to the Pope in evidence of his ability to do decorative work for his Holiness. It is caused in this case by faecal impaction secondary to incomplete evacuation of faeces over an extended length of time, leading to the formation of a faecaloma—a large, firm mass of stool.

The aetiology of faecaloma is multifactorial; risk factors include advancing age, previous obstetric trauma, diabetes, stroke, drugs, and dementia.

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Carbon monoxide poisoning on a motor launch: part 1

Published in NZMJ 1909;7(30):42–45 and written by Dr W J Barclay, Thames.

At the present time the explosive engine burning petrol or allied liquid is in extensive and increasing use, especially perhaps as providing a cheap and convenient means of propulsion. A device that has rendered possible the motor car and the motor boat, not to speak of the submarine and the aeroplane, must be accounted a signal boon to mankind. But, unfortunately, like every good gift, the explosive engine is not perfect, and has certain disadvantages and dangers. One of these is illustrated by the following case :—

On the 14th April last, five men went out fishing on a motor launch propelled by a 6 h.p. benzine engine. Of the five men on board, four were regular fishermen and one a friend having a day's outing. This man was a strong, healthy young fellow, about 20 years of age; he was in good health, and apparently enjoyed his holiday. When darkness came on fishing ceased, and the launch started on the return journey. The regular crew set to work as usual, one going into the cabin to mind the engine, the others remaining outside and occupying themselves with the fish.

The visitor feeling drowsy, and having no particular task, went into the cabin, crawled right forward past the engine, and lay down to sleep. This was about 8 p.m. Shortly after, the man tending the engine heard the visitor groaning and called out to him, but, receiving no reply, thought he was perhaps feeling seasick in the heat of the cabin, and wished to be left alone. Apart from this the visitor lay quiet, and was presently thought to be asleep.

About 11.30 p.m. the boat arrived home, and as the visitor did not turn, out one of the crew went to wake him. This, however, was found impossible; he could not be roused, and assistance was sent for. I saw him about midnight. He had been removed to a neighbouring house, and was lying on a couch. The face looked natural in colour, so much so that at first glance I thought the man was living, and was surprised on examination to find that he was dead. The body was still warm, but no sign of heart's action or of breathing could be noticed, even after hypodermic injection of strychnine and prolonged use of artificial respiration.

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Antioxidant supplementation for prostate cancer prevention

Antioxidant micronutrients such as vitamin E and vitamin C may delay various steps in carcinogenesis. Similar claims have been made for selenium supplements. These claims have been tested with respect to prostate cancer in two recently reported randomised trials. In one trial, 35,533 men aged 50 years or more were randomised between selenium and/or vitamin E supplements or placebo. At a median follow-up time of 5.46 years it was concluded that selenium or vitamin E, alone or in combination did not prevent prostate cancer in this population of relatively healthy men. The other trial involved 14,641 American male doctors who were randomised to vitamin E and/or vitamin C or placebo. At a mean follow-up time of 8 years it was concluded that neither vitamin E nor C supplementation reduced the risk of prostate or total cancer.

JAMA 2009;301(1):39–51 & 52–62.

Screening for coeliac disease—yes or no?

Coeliac disease (CD) is an autoimmune disease, triggered by the ingestion of gluten. It may cause an inflammatory reaction and damage to the small intestine in genetically susceptible individuals. Histologically, diagnosis is demonstrated by flattened or clubbed intestinal villi and these changes reverse on a gluten-free diet.

In this paper, the prevalence of positive results of anti-tissue transglutaminase (anti-tTG) antibody assays and coeliac disease (CD) in a rural Australia population are reported. In 47 of 3011 serum samples (1.56%), at least one anti-tTG assay gave positive results: 31 of the subjects who provided these sera were available for clinical review, and subsequent testing—tissue biopsy or repeat assay resulted in 17 cases of CD. The others were regarded as equivocal. They concluded that a single positive anti-tTG antibody assay was of poor utility. They reported a prevalence rate of 0.56% in their community. An editorial commends their efforts but concludes that their data does not justify population-based screening for CD.

MJA 2009;190:429–32 & 404–5.

In-flight oxygen supplementation

The question often arises about whether an hypoxic patient can fly on a commercial flight and whether supplemental oxygen is available? The authors of this paper have addressed this problem with vigour. Their focus is on Australian/NZ airline policies and they have sought answers from 54 airlines servicing Australia and NZ. 43 (81%) reported that they could support passengers who required in-flight oxygen. The majority (88%) provided a cylinder for the passenger to use. The costs of the service varied—6 (14%) free oxygen—but half of these charged for an extra seat. Fifteen (35%) charged per cylinder and 14 (33%) had a flat rate charger per sector.

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The authors recommended standardisation of airline policy on this matter. They note that Air NZ, Pacific Blue, and Qantas each have a specific helpdesk for patients with medical problems. This informative paper should be a very useful resource document for appropriate patients and their doctors.

Respirology 2009;14:589–94.

Trying out the polypill

It is 6 years since Professor Wald hit the news with the polypill. His provocative paper "A strategy to reduce cardiovascular disease by more than 80% (BMJ 2003;326:1419–24)" promised a new era in preventive medicine. What has happened since? Well a recent Lancet offers some follow-up. An Indian trial involving over 2000 patients aged between 45 and 80 years of age, each having one cardiovascular risk factor has recently been reported. Their version of the polypill consisted of low doses of thiazide (12.5 mg), atenolol (50 mg), rampipril (5 mg), simvastatin (20 mg), and aspirin (100 mg) per day.

The trial was complicated—only 412 subjects were assigned to the whole polypill and there were 8 other groups taking 1, 2, 3, or 4 of the constituents. At 12 weeks they report that those taking their polypill had reductions in LDL cholesterol, heart rate, blood pressure, and platelet activity. Their conclusion was that it was a feasible proposition for people to take such a pill and that the results to date are favourable. The more cynical await the result of a less complicated trial over a much longer period.

Lancet 2009;373:1341–51.

A touch of troponinaemia

A correspondent to the BMJ is concerned about the epidemic of mild troponinaemia and overdiagnosis of myocardial infarction. We are reminded that increases in troponin are often seen in patients with multiple comorbid conditions such as diabetes and heart or kidney failure who present with dyspnoea, infections such as pneumonia, exacerbation of chronic obstructive lung disease, or atypical symptoms.

Such patients are often, perhaps very often, diagnosed as having had a non-ST elevation MI (NSTEMI). What often follows is the prescription of aspirin, clopidogrel, statin, and β-blocker. Which would be good if the patient had really had a NSTEMI. On the other hand a waste of resources and possible risks if they have not. Our correspondent feels that a way round the problem would be to create a new term such as "mild troponinaemia of indeterminate origin (mTIO)" akin to monoclonal gammopathy of unknown significance (MGUS).

Your scribe alternatively suggests that perhaps biochemists should designate a higher normal range of troponin values, or maybe clinicians should be discriminatory when ordering tests.

BMJ 2009;339:494.

GlaxoSmithKline (GSK) and Pfizer join forces on HIV

GSK and Pfizer, the two largest pharmaceutical companies, have recently announced a plan to merge their HIV drug divisions. On the face of it a philanthropic gesture that should benefit HIV patients. However an analyst at consultancy Datamonitor Healthcare in London takes a cynical view. He points out that although GSK has a much greater share of the anti-HIV drug market than Pfizer, its drugs are nearing patent expiration and sales are slowing. Pfizer has a smaller market presence, but owns a healthier pipeline of candidate HIV drugs. Perhaps sharing intellectual property may be both good business and helpful to HIV sufferers?

A WHO initiative to launch a 'patent pool' by the end of this year that would allow multiple companies to license their anti-HIV drugs in return for royalties might be even better in speeding up antiretroviral research.

Nature 2009;458:950–1.

THE NEW ZEALAND MEDICAL JOURNAL
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Management of adult superficial acute abscesses: lancing the collection

We congratulate Drs Baker and Windsor on their cutting review of acute management of superficial abscess at Auckland City Hospital in the 22 May issue of the *Journal*.[1] In doing so they have laid-open the near universal problem of timely access to operating theatres for semi-urgent procedures,[2] and that of soft tissue abscess drainage, in particular.

Definitive abscess management has changed little since the time of Hippocrates—incision and release of the offending humor. Conditions under which this is effected (thankfully) has—with evolution of sophisticated means of providing both analgesia and anaesthesia—now become routine. In the main, provision of inpatient anaesthetic services are (rightfully), geared toward dealing with cases of highest acuity first. The inevitable consequence is increased morbidity suffered by those of lower urgency through delayed treatment, potentially associated with repeated enforced starving, and the attendant financial implications to both individual and health system. Such harm is comprehensively reported by the authors.

Finding appropriate solutions to the problem of timely theatre access for acute semi-urgent procedures is likely to prove institution dependent. Nevertheless some broad conclusions may be drawn. Clearly the majority of patients with superficial acute abscesses admitted under a General Surgical team were suitable for treatment in an ambulatory setting. Availability of both a day-stay theatre facility, and the necessary processes required to access such a service in a timely manner, would undoubtedly result in significant efficiencies.

Many patients with cutaneous abscesses may additionally be dealt with expeditiously within the confines of the Emergency Department, without need for admission. The expanding role of Emergency Physician as sedationist[3,4] provides facility for uncomplicated abscess drainage to be performed in carefully selected patients, definitively at initial presentation.

Indeed, at Waikato Hospital, Emergency Physicians trained in procedural sedation and regional anaesthetic techniques routinely provide such as service to both adult and paediatric patients. 750 such procedures were completed in 2008 of which a significant number comprised abscess incision and drainage.

Similarly, utilisation of available local expertise may serve to relieve pressure on precious inpatient resource - prior to dehiscence.

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THE NEW ZEALAND MEDICAL JOURNAL
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Non-operative management of breast abscess

The recent article on management of adult superficial acute abscesses by Baker and Windsor highlights the significant workload in general surgery created by inpatient management of abscess cases.[1] 157 cases of breast abscess (13% of cases) are reported and it is interesting to note that only 1 of these was treated with aspiration. Whilst there may well be a selection bias in the data due to preferential admission of those patients with more severe infection, there is scope for cost-effective, routine outpatient management of many of these patients.

Non-operative treatment of breast abscess with aspiration and antibiotics has been reported with high success rates.[2–7] Lactational and non-lactational abscesses have been successfully treated in this manner. Protocols validated at Edinburgh Breast Unit in the 1990s have demonstrated that few (if any) breast abscesses require incision and drainage under general anaesthesia. Blind needle aspiration has been shown to be effective.[5]

Clinical examination of the inflamed breast however can be painful and difficult. Assessment with ultrasound on presentation to the Emergency Department or surgical unit simplifies this procedure, identifies patients with a discrete collection of pus and allows for immediate ultrasound-guided aspiration under local anaesthesia. The patient goes home and remains on oral antibiotics. Clinical and ultrasound review at 2–3 day intervals is required with repeated aspiration until no further pus forms.

Request for formal ultrasound assessment in the radiology department can result in delays and may require admission on antibiotics while this procedure is awaited. The emergence of Clinician Performed Ultrasound provides an opportunity to modify existing protocols and to ease the burden on overloaded radiology departments.[7] Ultrasound is already used by both Emergency Department clinicians (FAST assessment of abdominal trauma), and anaesthetists for placement of central lines.

Access to mobile ultrasound units in the Emergency Department and theatre will facilitate implementation of these protocols. Training is now available for surgeons and surgical trainees and courses are run with support of the RACS.[8] Within New Zealand The Advanced Surgical Skills Centre at Auckland Hospital ran a one-day course on Ultrasound for Breast Surgeons in November 2008, and this will be repeated on 12 September 2009.[9]

The cost benefits of day case management of adult, superficial acute abscess have been well presented by Baker and Windsor. Routine outpatient management as proposed would further enhance these savings and free-up much needed hospital beds. There are also significant advantages for the patient who can avoid hospital admission, general anaesthetic, weeks of wound dressings, and a scar on the breast. In case of lactational abscess, non-operative management also facilitates breastfeeding.

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THE NEW ZEALAND MEDICAL JOURNAL
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Beliefs about homeopathy among patients presenting to GP practices

The New Zealand Council of Homeopaths (NZCH) welcomes a survey of the use of Homeopathic medicines published in the 22 May issue of the *New Zealand Medical Journal* on a survey of 124 people in Doctors' surgeries.[1] Of these, 65% said they had used homeopathic remedies with 92% reported experiencing a positive result. These findings confirm the results from studies conducted overseas.[2–4]

Patient demand for a system of medicine that is natural, safe, and effective has driven the rise of homeopathy in New Zealand and throughout the world. However, very few surveys on homeopathy have been conducted in New Zealand to date so it is pleasing to see that funding is being made available for this purpose.

Homeopathic consultations are individualised to each patient, taking into account all presenting symptoms, together with a detailed family and personal history, including the context in which the patient became unwell.

A homeopathic prescription is then selected based on the patient's unique symptom presentation. Homeopathic treatment facilitates the body's ability to fight infection and to decrease susceptibility to disease by gently stimulating the body to heal itself.

This research is the beginning of an exciting development into adding to previous studies understanding homeopathy. We hope that funding will be made available to conduct further surveys and trials with practicing homeopaths in their clinics, to further add to the body of scientific knowledge into the healing powers of homeopathic remedies.

Gwyneth Evans
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Medical student action and the "Global Week of Action Against Gun Violence 2009"

15–21 June 2009 is the "Global Week of Action Against Gun Violence" during which activists around the world raise awareness, campaign for better gun laws and push for stronger regulation of the global arms trade (http://www.iansa.org/campaigns_events/WoA2009/index.htm).

Globally, small arms and light weapons kill an estimated 1000 people per day, the majority of whom are civilians. Injury from gun violence is a preventable public health problem.[1]

In New Zealand, medical students are actively working to prevent gun violence in the Pacific. The students, who are members of the New Zealand Branch of the Nobel Peace Prize winning organisation, the International Physicians for the Prevention of Nuclear War (IPPNW), have contributed to a Pacific-focussed programme of arms control and disarmament to compliment other major IPPNW programmes in Africa, Latin America, and South Asia (http://www.ippnw.org/Programs/AFP/index.html).

In particular, a group of University of Auckland students are currently assessing the success of the United Nations-supervised disarmament programme that followed the decade of war in Bougainville in the North Solomons Province of Papua New Guinea (PNG). Peace negotiations were brokered by the New Zealand Government in 1998, but by the time the conflict ended, 10% of the population of Bougainville or approximately 15,000 civilians had died.

At present semi-automatic weapon fire is heard regularly in Arawa, the former capital of Bougainville (NZ Volunteer Service Abroad workers, personal communications). In the absence of sustained disarmament, the continued availability of weapons can lead to increased numbers of deaths and a level of weapons related injuries that, in some cases, is only slightly reduced from that observed during a period of conflict.[2] This research project uses retrospective analysis of hospital records to assess the relative frequency of weapon injuries during and after periods of war and disarmament.

It has found that such hospital data can identify groups at risk of injury. For example, preliminary results suggest subsistence farmers are being injured and killed by accidentally detonating unexploded ordnance left from the conflict. Once these risk factors have been identified, interventions can be designed to prevent further injuries and deaths.

In another project, one of us (AW) as a medical student on his elective, has researched the human cost of small arms proliferation by quantifying the public health consequences of tribal wars in the highlands of PNG. The initial findings were presented at the 44th Medical Society of Papua New Guinea Symposium in 2008[3] and it is hoped that this work will be further developed to contribute to civil society campaigns such as the Coalition to Stop Gun Violence PNG (which includes Oxfam and the United Nations Development Program).

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These campaigns need credible evidence and engaging 'One Bullet Stories'[4] so as to inform and motivate key decisionmakers to take action on gun control policy reforms. This work aims to support the ongoing exploration of having a Pacific-wide injury surveillance system that would provide key epidemiological information to inform violent injury prevention and control strategies.

The longer term goal is a "Gun Free Pacific Zone" similar to the "Nuclear Weapon Free Pacific Zone" which, 20 years later, is only 4 countries short of being a Nuclear Weapons Free Southern Hemisphere.

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Competing interests: The authors are members of the non-profit organisation: International Physicians for the Prevention of Nuclear War (NZ Branch). Funding for the research in the PNG Highlands and in Bougainville was provided by Peace and Disarmament Education Trust.

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Professional Misconduct – Note Taking False and/or Misleading

The Charge

Dr Suresh Kumar Vatsyayann, a General Practitioner of Hamilton, was charged with professional misconduct following a charge laid by a Professional Conduct Committee ("PCC") on 20 June 2008. The charge was later amended by the withdrawal of particulars 1 and 2 as set out below.

Particulars of charge:

1. (Withdrawn)
2. (Withdrawn)
3. That Dr Vatsyayann produced false and/or misleading clinical notes, which assert that he was consulted by Ms Tamara Browning on 2 April 2007 when Ms Browning did not consult with Dr Vatsyayann on that date.
4. That Dr Vatsyayann produced false and/or misleading clinical notes which assert that when he was consulted by Ms Tamara Browning on 14 May 2007, her carotids, peripheral pulses and abdomen were examined and she was checked for peripheral oedema. He reiterated the accuracy of his notes in the letter dated 11 April 2007 to the PCC.
5. That Dr Vatsyayann produced false and/or misleading clinical notes, which assert that, when he was consulted by Ms Jaren-Anne Holland on 26 June 2008, he took a full family and personal history and examined her carotids and legs

Finding

In its decision dated 22 December 2008, the Tribunal found that the charge of professional misconduct was proven.

Background

This case concerns the consultation notes produced by Dr Vatsyayann. The allegations were that on 2 April 2007 he claimed that he saw Ms Tamara Browning when in fact she was seen on that date by Dr Gilgen, a (then) suspended medical practitioner. The evidence in support of this was the testimony of Ms Browning, her family support worker Ms Gloria Duncan-Kiriwera, who attended the consultation with Ms Browning, and the medical notes themselves. An audit was carried out on the computer of Dr Vatsyayann, which showed that the consultation notes were typed by user "DAV". This user has been confirmed to be Dr David Gilgen. However, when printed, the notes showed that the provider of the service was "JOY", the user name

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for Dr Vatsyayann. Dr Vatsyayann said parts of the notes were entered by Dr Gilgen and other parts he entered personally. The question for the Tribunal was whether or not Dr Vatsyayann did see Ms Browning and whether particular 3 was established.

The second part of the charge is contained in particulars 4 and 5 is essentially an allegation that Dr Vatsyayann's notes do not accurately record the examinations he carried out in that the notes show that Dr Vatsyayann examined Ms Browning's carotid artery, peripheral pulses and abdomen and checked for peripheral oedema. Ms Browning says none of these things happened.

A similar assertion is made in respect of the consultation Dr Vatsyayann had with Jaren-Anne Holland (Nikora) on 26 June 2007. The allegation is that he failed to take a full family and personal history or to examine her carotids and her legs but recorded that he did.

Reasons for Finding

The Tribunal weighed up the evidence from each of the witnesses and looked at what external or confirming documents existed to help it in ascertaining the veracity or otherwise of the witnesses.

The first, Particular 3, was that Dr Vatsyayann produced false and/or misleading clinical notes, which asserted that he was consulted by Tamara Browning on 2 April 2007 when Ms Browning did not consult with Dr Vatsyayann on that date.

In his letters to the PCC, Dr Vatsyayann was adamant that he had seen Ms Browning on 2 April. He did, however, allow in those letters, that Dr Gilgen may also have seen her in his role as physician's assistant.

He said he could not recall anything about the consultation. He did, however, recognise in the notes some of the ways and expressions he used habitually when making notes.

Ms Browning and Ms Kiriwera were adamant that they did not see Dr Vatsyayann on 2 April.

The Tribunal was persuaded by the independent evidence of Ms Kiriwera. Ms Kiriwera spoke very highly of Dr Vatsyayann and could not praise him enough for the way he had behaved towards her and her family generally and especially over the death of her daughter in 2007. She genuinely feels that Dr Vatsyayann is a good doctor and was sad to have caused him grief and difficulty in giving her evidence. The Tribunal found this evidence very persuasive.

The Tribunal did not accept the evidence of Ms Foot (Dr Vatsyayann's daughter), which was that Ms Kiriwera had said to her at a party that she had not accompanied Tamara Browning into the consultation room. The Tribunal could not see any reason why she would not tell the truth and why she would not remember that the consultation was with Dr Gilgen and not Dr Vatsyayann unless it was the truth. An unusual event such as seeing someone that she was not used to seeing is in fact more likely to remain in her mind than a consultation with her own and respected family doctor.

There was also some corroborating evidence within the notes themselves, which showed that they were all written on one computer by "DAV". Of course, the Tribunal could not discount the evidence Dr Vatsyayann gave; that he went into the consultation room and entered notes after some notes had been entered by Dr Gilgen. However, the Tribunal did think that that was highly unlikely given the evidence of Ms Browning and Gloria Kiriwera. The witnesses were segregated but both Ms Kiriwera and Ms Browning said that Dr Gilgen went out of the room and returned with a signed prescription.

Dr Vatsyayann said he had no recollection of the consultation so was therefore not able to say that he could remember the consultation. He did say, however, that it would be unusual for him not to have seen a patient for whom a new prescription was being given but there was nothing about the consultation that stood out in his mind. It may be because he sees a large number of patients a day and this was not an unusual consultation or alternatively that he did not see her at all or that he has simply forgotten.

Dr Vatsyayann's evidence regarding the way in which the notes were written also had to be considered. The Tribunal looked at those notes. The notes made by Dr Vatsyayann in the May consultation and the consultation with Ms Jaren Holland on 26 June 2007 were quite different. The 26 July 2007 notes appeared to be a stream of consciousness reflecting Dr Vatsyayann's own evidence that he wrote notes of things as he observed them. He clearly used "Hot Keys" and other than the word "impression" [CF IMP], which appeared in Ms Browning's notes (but not Ms Holland's notes), the notes did not seem to have the same structure and layout as the notes of Dr Gilgen. Dr Gilgen's notes had a clear structure and use headings and more formal language than are found in the two examples of Dr Vatsyayann's notes.

The Tribunal therefore concluded on the balance of probability that Dr Vatsyayann did not see Ms Browning on 2 April 2007.

When read as a whole the particular also focuses the attention of the Tribunal on the fact that Dr Vatsyayann [and the notes] asserted that he saw Ms Browning. Dr Vatsyayann has never accepted that he did not produce the notes. The notes have always been presented on the basis that they were Dr Vatsyayann's notes regardless of the fact that Dr Vatsyayann's name always appears on notes printed from the Family Clinic. He continued to assert he saw Tamara Browning on that day because he provided a prescription for anti depressants for her, which he signed and which Ms Browning filled. He asserts that both he and Dr Gilgen saw Ms Browning and wrote the notes.

If Dr Vatsyayann did not see Ms Browning, he should have acknowledged that he did not see her on that day. There may have been consequences to Dr Vatsyayann if she was seen by a medical practitioner who was suspended from the register but Dr Vatsyayann has continued to assert, despite his lack of ability to remember the consultation, that he must have seen her on that day and produced notes for this consultation. The Tribunal therefore found Particular 3 established.

Particulars 4 and 5 relate to the entries in the notes of the examinations supposedly carried out by Dr Vatsyayann when the witnesses say that they did not carry out those examinations.

In respect of **Particular 4,** Dr Vatsyayann's evidence was that he listened with his stethoscope to Ms Browning's chest and felt her neck. He said he asked her about her tummy and looked at her feet. The issue for the Tribunal was whether all of the tests/observations shown in the notes were actually carried out. If not, the note were false and/or misleading.

The Tribunal did find that the notes were misleading in that the list of tests/examinations or observations created by a Hot Key did seem to suggest a thorough and detailed examination of the areas of the body such as carotid, peripheral pulses and abdomen and peripheral oedema were carried out when they were not carried out except in a very cursory way. The phrases used have a commonly understood meaning for doctors. For example, asking Ms Browning whether she had any tummy problems (as Dr Vatsyayann says he did) the Tribunal finds does not constitute abdominal examination sufficient to use the words "abdomen NAD". The Tribunal considers that notes must have the ability to be read universally otherwise any subsequent doctor treating either patient would believe that these tests had been carried out in an accepted way.

In determining **Particular 4** the questions for the Tribunal were therefore:

Question 1	*Do the notes assert an examination of the carotids, peripheral pulses and abdomen?*
Answer	*Yes. Despite Mr Waalkens' submission that the notes do not use the word "examination" or "OE", these phrases do have commonly understood meaning and do tell a doctor that the commonly understood examinations were carried out.*
Question 2	*Were the examinations carried out?*
Answer	*No, See above. Dr Vatsyayann describes his examinations and even on his evidence they were not examinations.*
Question 3	*Did Dr Vatsyayann therefore produce false or misleading notes?*
Answer	*Yes, the notes were misleading as they may subsequently mislead other doctors as to Ms Browning's health.*

The Tribunal found Particular 4 was established. However, on its own, the Tribunal considered this particular would not reach the threshold to warrant a disciplinary sanction against Dr Vatsyayann.

In respect of **Particular 5**, the evidence from Ms Holland (now Ms Nikora) was that he did not take a full family history from her otherwise she would have advised him of significant history of medical conditions within her family. Dr Vatsyayann says that he did ask her those questions (although he cannot remember them) otherwise her family history would not have been recorded in his notes. He did say that family history notes were created by a Hot Key but that he amended them. The notes of Ms Nikora's family history are clearly incorrect and the Tribunal found it more likely than not that this is because Dr Vatsyayann made an error in either recording or in

asking Ms Nikora. The Tribunal could find no reason as to why Ms Nikora would not tell her general practitioner about her family history.

The Tribunal accepted the possibility that there were some examinations carried out by Dr Vatsyayann that the patients did not remember. Ms Nikora's initial complaint was to do with the circumstances in which she was seen and the way in which the examination was carried out. Nonetheless, she said that when she got her notes she ascertained that there were some incorrect entries in them. However, Dr Vatsyayann's evidence is not that he carried out examinations in the manner set out by Dr Lillis (the expert witness), but that he used his electronic stethoscope to listen and then observed many other items which were listed.

The Tribunal found that Dr Vatsyayann did not examine her carotids and legs. He may have looked at them but that was all.

In determining **Particular 5** the Tribunal had to ask similar questions to particular 4.

Question 1	*Did Dr Vatsyayann's notes assert examination of carotids and legs?*
Answer	*Yes. The carotid is examined by feeling the pulse and listening with the stethoscope over the pulse in the neck Legs are examined by close inspection of the legs and feeling the pulses and for peripheral oedema; when not apparent on simple inspection, by application of pressure to indent the skin.*
Dr Vatsyayann did not carry out these tests.	
Question 2	*Do the notes assert that Dr Vatsyayann took a full family and personal history?*
Answer	*They assert that there was no family history of certain diseases.* This was wrong but there was no assertion of full family and personal history, except insofar as this can be implied from family history noted.
Question 3	*Were these notes false or misleading?*
Answer	*Yes, misleading.*

The Tribunal found particular 5 was established. However, on its own, the Tribunal considered this particular would not reach the threshold to warrant a disciplinary sanction against Dr Vatsyayann.

The Tribunal found that on the balance of probability the three particulars were proven.

In respect of particular 3, the Tribunal found that there was a significant shortfall in the doctor's conduct. It also made a similar finding for particulars 4 and 5. Accurate notes are a vital and an important part of practice.

Penalty

The Tribunal has concerns over the clinical management of Dr Vatsyayann's practice and in particular the way in which notes were made using Hot Keys and recorded in the computer so that they only show Dr Vatsyayann as preparing the notes when they actually have been prepared by others on Dr Vatsyayann's staff, primarily his physician/GP assistants.

The extent of the use of Hot Keys was also of concern in this particular case as it gave the reader of the notes a clear impression that a number of clinical tests had been undertaken which were not undertaken.

The veracity of the notes has significant clinical implications for Dr Vatsyayann's patients and for any future clinical management of those patients. The Tribunal noted there is a real risk of harm if the Hot Keys are used without amendment. Accurate and thorough notes are an essential tool for any doctor to master and they are essential for good clinical management.

The Tribunal therefore considered it appropriate to impose conditions upon Dr Vatsyayann's practice, which ensure that the matters, which are of concern to the Tribunal, are dealt with and improved. The Tribunal regarded this as a matter of safety for the public and particularly for Dr Vatsyayann's patients.

In its supplementary decision of 26 April 2009, the Tribunal imposed the following penalty on Dr Vatsyayann:

(a) That Dr Vatsyayann be censured.

(b) He is fined the sum of $5,000.00.

(c) He is to pay 20% of the PCC's costs and 30% of the Tribunal's costs.

(d) The following conditions imposed on the practice for a period of two years:

i. That Dr Vatsyayann's note taking, in particular, but not restricted to, the appropriate use of hot keys and the recording of the name of the author typing the notes, be monitored by a suitable person appointed by the Medical Council of New Zealand;

ii. That Dr Vatsyayann comply with any request that arises during and/or following the monitoring process, to the satisfaction of the Medical Council of New Zealand; and

iii. That Dr Vatsyayann complete the Royal New Zealand College of General Practitioners Cornerstone accreditation and audit process and implement such changes as are recommended by the Royal New Zealand College of General Practitioners to achieve the Cornerstone accreditation status.

Appeal

Dr Vatsyayann lodged an appeal with the High Court on 12 February 2009. His appeal sought Court orders:

(a) To quash the finding of the Tribunal, whereby it found Dr Vatsyayann guilty of Particulars 3, 4 and 5; and

(b) Setting aside the finding of professional misconduct both separately and cumulatively.

The full decisions relating to the case can be found on the Tribunal web site at www.hpdt.org.nz
Reference No: Med08/96P.

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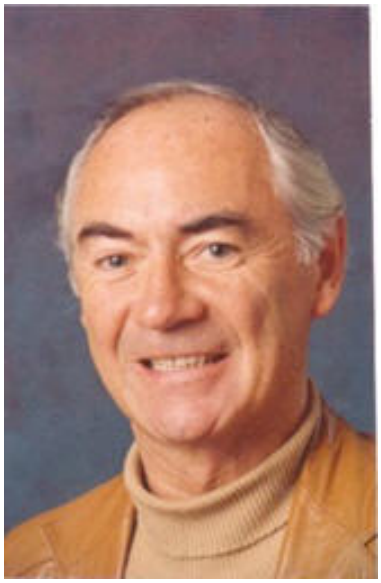
THE NEW ZEALAND MEDICAL JOURNAL
Journal of the New Zealand Medical Association

Joseph Brian Sheils

7 April 1925–17 May 2009

Dr Joseph ("Joe") Sheils was born in County Armagh, Northern Ireland. In 1944 he began formal medical training at the Royal College of Physicians & Surgeons in Dublin, Eire.



Postgraduate experience was attained in the Meath Hospital, Dublin and at Maelor General Hospital, Wrexham, North Wales; 1952–1954 was spent in General Practice in Liverpool, England.

In 1954 Joe obtained a Commission in the Royal Australian Navy and in 1956 was transferred to Manus Island in New Guinea where he was Senior Medical Officer in Charge for 2½ years gaining a wide experience in tropical diseases—while handling the stress needs of the three Armed Forces and their dependants. Between 1960 and 1963 he worked in a very mixed General Practice in Suva, Fiji with a big midwifery practice. This was followed by 6 months as Surgical Registry in the Colonial War Memorial Hospital, Suva.

In the mid 1960s Joe was appointed Medical Superintendent, Apia General Hospital in Western Samoa. The position included Outpatient Clinics in neighbouring Islands and (until the appointment of an Obstetrician in 1965) he was in charge of the maternity wards.

In 1966 Joe was appointed Medical Superintendent, Whangaroa Hospital, Kaeo, Northland, New Zealand and Medical Officer, Whangaroa Special Area. This interesting position consisted of General Practice, a small obstetrics ward, and minor surgical procedures. After 10 years as medical officer in this country area he was entitled to sabbatical leave which he took as Medical Doctor on a freighter sailing around Cape Horn—a part of the world he had not traveled before. He spent time in hospitals in Ireland before returning to New Zealand through USA.

In 1982 Joe joined the Department of Health, Takapuna area as a Community Medical Officer. His varied duties included the clinical, medical, and developmental examination of pre-school, primary, intermediate, and high school children.

Joe was a keen cruiser/sailor with his own boat. He enjoyed outdoor life generally and took a keen interest in bird life, land and sea animals, and their preservation. All his life he enjoyed gardening and landscaping, swimming, bushwalking, and scuba diving.

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Joe retired in 1990 and together with partner Rhonda developed their Rakino Island property, and continued his love of marine activities and gardening. They also travelled abroad to catch up with family remaining in Ireland and USA as well as several trips into Asia.

His failing eyesight (and more recently, strokes) reduced his journeys and activities. The last 18 months were spent at Valley View Home and finally Te Mana Home and Hospital.

Dr Sheils is survived by his partner Rhonda, 5 children, 10 grandchildren, and 2 great grandchildren.

Jan Reiher (a daughter) wrote this obituary.

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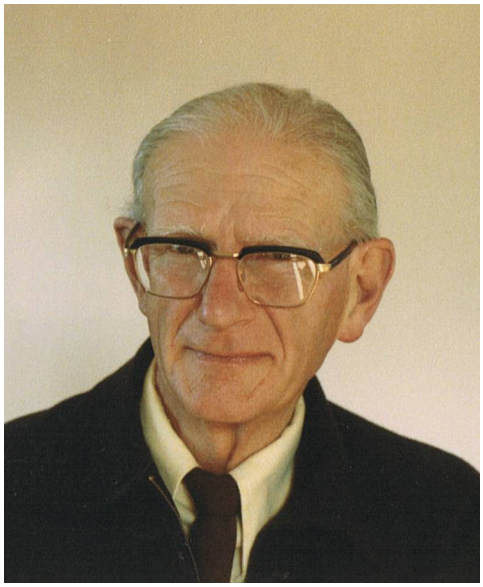
THE NEW ZEALAND MEDICAL JOURNAL
Journal of the New Zealand Medical Association

Charles Plummer Powles

July 1913–May 2008 (FRACP, Queen's Service Order)

Dr Charles Plummer ("Peter") Powles spent the greater part of his professional life in Wanganui.



He was born in Palmerston North, the younger son of Charles Guy Powles and Jessie Mary (nee Richardson) and because of his father's Army career had a peripatetic early life and education, at Marsden School in Wellington (then co-educational), Wellesley College, and as a boarder at Wanganui Collegiate School.

At the height of Great Depression of the 1930s he began medicine at Otago, living in Selwyn College and editing the college magazine and later the Otago University magazine, *Critic*. After graduation, intending a surgical career, he worked at Wellington Hospital as a junior resident, then in the Pathology Department and later as surgical registrar.

He met and married Marjorie McMurtrie and volunteered for service in the NZRAMC being posted to the Middle East where he served in the 1st NZ General Hospital and the Forward Transfusion Service, taking part in the successive advances and retreats along the North African coast, but unfortunately developed pulmonary tuberculosis which changed the course of his life in major ways.

After being invalided home in the era before chemotherapy, an unsuccessful artificial pneumothorax was followed by an extensive two-stage thoracoplasty and a near-fatal massive pulmonary embolus but he was able to resume medical work as a Medical Officer at Otaki Sanatorium and then, abandoning his surgical plans, studied successfully at Wellington Hospital for the MRACP and worked as Medical Registrar at the Hutt Hospital where his association with Dr J Watt (later Professor of Paediatrics at Otago) was to prove valuable later. His illness cast a great shadow over his life and he was deeply grateful for Marjorie's devoted care.

He applied successfully for the position of Senior Physician to the Wanganui Hospital and worked there for the rest of his professional life before retiring in 1986 and moving with Marjorie to Waikanae where they lived until his death after a short illness. Initially his responsibilities included Paediatrics as well until a later paediatric appointment was made. Later he studied overseas in London, and in the USA in the field of poliomyelitis in relation to his appointment as Visiting Physician to the Duncan Hospital for Poliomyelitis in Wanganui. Encouraged to take an interest in alcohol problems, he studied at the Addiction Research Foundation in Toronto and

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started and developed the Alcohol (later Alcohol and Drug) Assessment Unit at Wanganui Hospital.

As well as a heavy clinical load at hospital and in private consulting practice he played a full part in hospital affairs with terms as Chairman of the Medical Staff Committee and Postgraduate Committee during which time be founded the Wanganui Medical Education and Research Foundation and the Porritt Lecture to commemorate the then Governor General, Wanganui-born Sir Arthur Porritt, (later Lord Porritt of Hampstead and Wanganui) who gave the initial lecture.

He also served in various roles in the Wanganui Division of the NZMA, in particular as a longstanding member of the Ethical Committee. His interest in education, and his example in individual patient care, led to later tributes from colleagues who had worked under him of the importance of that experience.

He early recognised the importance of community support groups and contributed fully and over long periods to the work of the Wanganui Lay TB Association, the Society for the Intellectually Handicapped, the Wanganui Asthma Society, Wanganui Marriage and Family Guidance, Birthright Wanganui, and the Wanganui Epilepsy Association. In recognition of his services to medicine and the community he was awarded the Queen's Service Order (QSO) in 1987.

His recreations included golf, gardening, and a succession of family dogs. He was a talented watercolour painter and woodcarver and enjoyed classical music. Reserved in temperament, and not a man to put his own advancement foremost, his personal qualities earned the deep respect of his patients and colleagues, and a dry sense of humour was a real source of pleasure to his friends.

He is survived by Marjorie and their four children, the oldest of whom recently retired as Professor of Medicine from McMaster Medical School, Ontario, Canada.

Dr Richard Stone (retired doctor and former medical superintendant at Wanganui Hospital) wrote this obituary.

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