



The New Zealand Medical Workforce 1998



Level 12, Mid City Centre, 139-143 Willis Street, P O Box 11-649, Wellington, Phone 0-4 384-7635, Fax 0-4 385-8902

The New Zealand Medical Workforce in 1998

Summary

97% of practising doctors responded to the Medical Council's 1998 survey. The major findings were:

The size of the workforce: 8491 doctors were in active employment, an increase of 3.2% from 1997.

Demographics: Women were 31.3% of the workforce, up 1.1% from 1997. The proportion of overseas-trained doctors remained at 33.7%. Maori doctors at 2.3% and Pacific Islands doctors at 1.0% continue to be markedly under-representative of the general population.

Work by vocational group: The fastest growing areas since 1990 have been anaesthetics, diagnostic radiology, emergency medicine, general practice, internal medicine, paediatrics, psychiatry and general surgery.

Geographical distribution: In local authority regions, full-time equivalent general practitioners ranged from 27 to 189 per 100,000 population. The rate was highest in secondary urban areas (104), followed by main urban areas (95) and areas with less than 10,000 people (70).

Introduction

For nearly three decades the Medical Council of New Zealand has collected medical workforce data annually. Summaries have been published by the Council¹ and also by the Ministry of Health (1990² 1994³ and 1997⁴, including time series data) and the Clinical Training Agency (1995)⁵. This report describes the key results of the 1998 medical workforce survey.

Method

The sampling frame for the workforce survey is doctors with general or probationary registration, a current annual practising certificate (APC), and a New Zealand address at 31 March 1998. The questionnaire was posted out in February 1998 with APC applications, and those not responding were sent two reminder letters. All data were collected by 30 June 1998.

The questions for the 1998 questionnaire survey are essentially the same as 1997. This report also includes statistical information drawn from the Council's database, to avoid duplicating questions in the APC application (age, sex, registration date, graduation country and graduation year).

Geographical analysis uses territorial authorities and Health Funding Authority localities. Addresses of work sites were coded using census area unit data previously

supplied by Statistics New Zealand. HFA populations were determined by amalgamating territorial authority population estimates for June 1998⁶. Full time equivalents (FTEs) are calculated proportionately, so that 44 hours per week equals 1.1 FTE. Urban/rural comparisons use census urban area categories (as defined in Table 4) to classify the location of main work sites⁷. Results were generated using Access software.

Results

Response: At 31 March 1998 the medical register recorded a total of 8851 doctors practising medicine in New Zealand. 8604 doctors completed the questionnaire giving a response rate of 97.2%. Of the respondents, 8491 worked for four or more hours per week in New Zealand. The results in this supplement include only this group, who are described as "in active employment".

Size of the medical workforce: The workforce grew to 8491 active doctors, up 3.2% on 1997. This provides one doctor per 447 people in March 1998, compared to one per 386 people in Australia at December 1996⁸. This ratio has increased by 19% since 1990 and 44% since 1980. The largest contributors to recent growth are shown in *Table 1* and *Table 3*.

Table 1: Changes in the medical workforce 1990 to 1998

Capacity	Active doctors 1998	Percent increase 1990-98	Percent increase 1997-98
General practitioner	3,159	30.1	1.3
Primary care other than general practice	175	6.1	-1.7
House officer	910	34.0	8.6
Registrar	1,147	43.6	2.9
M.O.S.S.	261	50.9	-5.1
Specialist	2,536	29.9	3.1
Other	285	99.3	21.8
No answer	18		
Total	8,491	33.9	3.2

Medical Work by Vocational Group: The rate of growth for each vocational group is shown in Table 3, with the fastest growing areas since 1990 being anaesthetics, diagnostic radiology, emergency medicine, general practice, internal medicine, paediatrics, psychiatry and general surgery. The proportion of the total workforce undertaking training towards inclusion on the vocational register continued to rise, from 29% in 1997 to 34%. Over half of these were GPs. Groups where more than one third of the doctors described themselves as being in vocational training were general practice, emergency medicine, psychiatry, radiotherapy, occupational medicine and general surgery.

Hours worked: The median hours per week for all active doctors was 48 hours, for women 40 hours and for men 50 hours. Median hours declined with increasing age, from 55 hours per week for those aged 20-29 years to

46 hours per week for those aged 50-59. Doctors aged 65-69 had a median figure of 32 hours per week. House officers (55) and registrars (57) had the highest median hours per week. For specialists the median was 48 hours and for GPs 40 hours.

Table 2: GP workforce by HFA locality of main work site

HFA locality	Number of GPs	FTEs for GPs at all work sites	HFA locality population	FTEs for GPs per 100 000 population
Northland	117	128	143,350	89
Auckland	985	981	1,173,400	84
Waikato [†]	294	320	364,270	88
Bay of Plenty	206	208	241,500	86
Tairāwhiti-Hawkes Bay	144	160	193,650	83
Taranaki	82	87	106,920	81
Manawatu-Wanganui [†]	152	170	214,600	79
Wellington	357	351	428,680	82
Nelson-Marlborough	103	107	120,700	88
Canterbury-West Coast	467	462	518,520	89
Otago-Southland	252	268	285,900	94
Total	3,159	3,241	3,791,490	85

[†] Ruapehu TLA was included as part of Waikato HFA locality, though a smaller part of the population is in Manawatu-Wanganui.

Geographical distribution: The rate of full time equivalent GPs ranged from 79 per 100,000 population for the Manawatu-Wanganui HFA locality to 94 per 100,000 for Otago-Southland (Table 2). The disparity between the smaller territorial authority regions was more apparent, with FTEs for general practice ranging from 27 per 100,000 population (Carterton District) up to 189 per 100,000 for the Kaikoura district (*Appendix – Table 7 and Figure 1*). Only one of the fifteen city-based territorial authorities had a majority of overseas qualified doctors (Invercargill). In contrast 27 out of the remaining 59 authorities had a majority of doctors with primary medical training from overseas.

The territorial authorities in the lowest 20% for GP FTEs were Carterton, Manawatu, Waimakariri, Southland, Kaipara, Waikato, Tararua, Waimate, Franklin, Central Hawkes Bay, Selwyn, Western Bay of Plenty districts, Porirua and Waitakere cities (less than 66 FTEs per 100,000 population). The range for the highest 20% was 99-189 FTEs per 100,000. Previous work on the distribution of GPs in New Zealand has also identified uneven geographical distribution^{9,10}.

The 1996 workforce report by the Australian Medical Workforce Advisory Committee identifies reducing the

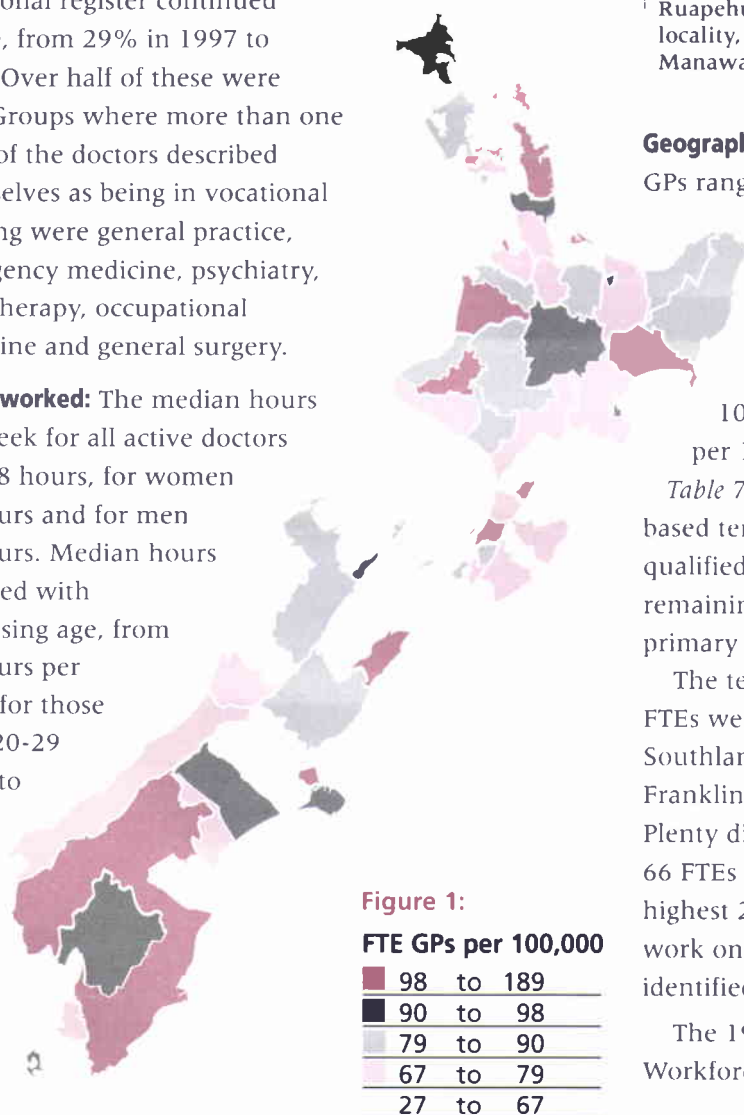


Figure 1:
FTE GPs per 100,000

98 to 189
90 to 98
79 to 90
67 to 79
27 to 67

Table 3: Vocational groups at main work site (house officers excluded)ⁱ

Vocational group ⁱⁱ	Number of doctors in main work site	Percent of total doctors	Percent change 1990 to 1998 ⁱⁱⁱ	Average hours worked (all sites)	Number in vocational training	Trainees as percent of vocational groups	Vocational registration, current APC, NZ address ^{iv}
Anaesthetics	498	6.6	38.1	50	160	32	332
Basic medical science	45	0.6	-47.4	51	-	-	-
Dermatology	42	0.6	11.4	44	3	7	43
Diagnostic radiology	255	3.4	37.4	44	65	25	188
Emergency medicine	103	1.4	550.0	46	96	93	8
General practice	3,007	39.7	30.1	41	1384	46	1478
Internal medicine	816	10.8	32.6	50	205	25	500
Obstetrics & gynaecology	197	2.6	14.3	48	53	27	185
Occupational medicine	46	0.6	-9.1	40	36	78	25
Ophthalmology	106	1.4	19.2	44	21	20	94
Paediatrics	236	3.1	43.6	51	73	31	158
Pathology	176	2.3	-2.7	45	37	21	166
Primary care	419	5.5	-	37	-	-	-
Psychiatry	447	5.9	32.6	44	167	37	265
Public health medicine & mgmt.	197	2.6	20.3	46	46	23	108
Radiotherapy	32	0.4	15.0	49	13	41	25
Rehabilitation medicine	15	0.2	-	42	4	27	3
Surgery: cardiothoracic	27	0.4	-69.1	57	5	19	19
Surgery: general	239	3.2	30.8	56	102	43	191
Surgery: neurosurgery	23	0.3	-	56	5	22	12
Surgery: orthopaedic	206	2.7	-	55	30	15	153
Surgery: other subspecialties	47	0.6	-	49	12	26	-
Surgery: otolaryngology	79	1.0	-	49	12	15	68
Surgery: paediatric	19	0.3	-	53	2	11	10
Surgery: plastic	43	0.6	-	53	10	23	31
Surgery: urology	50	0.7	-	52	9	18	38
Venereology	21	0.3	0.0	36	5	24	8
Invalid response	63	0.8			10		
Not completed	127	1.7					
Total	7,581	100.0	28.2	45	2,565	34	4,108

ⁱ Includes registrars, MOSSs and others not on the vocational register.

ⁱⁱ Based on vocational register branches, except for the categories "basic medical science", "primary care other than general practice" and "other surgical sub-specialties". Doctors working in health services administration and management are included in the "public health medicine and management" category.

ⁱⁱⁱ Percentage change 1990-98 is calculated for specialists and GPs only, since data covering the wider vocational group (including Registrars, MOSSs) is not available for 1990.

^{iv} Doctors on the vocational register at 31 March 1998 with a current APC and New Zealand address; includes multiple branches for individual doctors (96 second and 2 third registrations).

rural/urban gap as a major health goal. Analysis by urban area categories confirms a similar gap in New Zealand (Table 4). Rural and minor urban classifications have been amalgamated, as areas with populations of 999 and less would generally be serviced from a larger centre. This simple calculation does not substitute for careful analysis of local access issues, but does confirm a level of urban/rural inequality.

Table 4: GP urban/rural service levels

Census urban area categories, main work site	Population range	Population 1998	GP FTEs per 100,000	Median hours by GPs
Main urban areas	30,000+	2,510,400	94.7	40
Secondary urban areas	10,000-29,999	266,916	104.4	42
Minor urban areas, combined with rural and coastal areas	1,000-9,999 0-999	840,984	69.5	44

Table 5: Employment as percent of total hours worked, by capacity

Capacity	Solo private practice	Group private practice	Private hospital, commercial company	Health & Hospital Service	Government Department or Agency	University	Professional body	Other	Total
General practice	29.4	62.1	1.8	0.6	0.6	1.0	0.2	4.2	100
Primary care other than GP	14.8	19.6	25.2	2.9	4.2	8.7	3.8	20.7	100
House officer	0.0	0.0	0.8	98.8	0.0	0.0	0.0	0.3	100
Registrar	0.2	1.3	0.4	95.4	0.4	1.5	0.3	0.5	100
M.O.S.S.	0.2	0.0	4.7	87.2	3.2	0.5	0.1	3.8	100
Specialist	14.8	9.1	4.8	64.2	1.9	4.3	0.1	0.5	100
Other	2.5	2.0	10.0	11.0	9.0	41.2	2.4	21.8	100

Work environment: 87.3% of medical hours worked were performed at the main work site, 10.5% at the next main site, and 2.2% at all other sites. Employment patterns are complex as 44% of doctors worked at multiple work sites, typically with different employers. *Table 5* shows the proportion of total hours worked for each category of employer.

Sixty-four percent of work performed by specialists was for public hospitals, and 29% for the combined private sector (private hospitals, commercial companies, group and sole private practice). Sixty-two percent of all GP hours were worked in group private practice, with 29% in solo practices.

Distribution by sex and ethnicity: The overall proportion of women continued to increase to 31.3%, up from 23.9% in 1990 and 16.4% in 1980. Because of the increasing numbers of women training as doctors, their median age in the workforce (37 years) was significantly younger than men (43 years). The proportion of women varied widely among occupational groups (0% to 49%), with ophthalmology, rehabilitation medicine and all branches of surgery except paediatrics being less than 10% (*Appendix – Table 6*).

The increasing numbers of female GPs working shorter hours in urban practices has been highlighted in Australia recently¹¹. This trend also exists in New Zealand. Women make up 37% of all GPs in major urban areas, 31% in secondary urban areas and 28% in areas under 10,000 population (see *Table 4* for categories). The median hours per week is 32 for female GPs and 45 for male GPs.

The proportions of doctors identifying as Maori and Pacific Peoples were 2.3% and 1.0% respectively. These are markedly under-representative of the New Zealand population, at 14.5% and 4.8% respectively in the 1996 census. Projections by Statistics New Zealand forecast these proportions to rise to 17% and 8% by 2016 (based

on medium assumptions)¹². New admission initiatives have significantly boosted the combined number of Maori and Pacific students entering medical schools in 1999, to 22% of the intake at Auckland and 8% at Otago. The proportion of Maori among house officers was 4.3%, registrars 2.5%, GPs 2.2%, and specialists 1.4%.

Overseas trained doctors: The proportion of doctors who obtained their primary medical qualification in another country was 33.7% (*Table 6*), the same as in 1997 but up from 29.3% in 1990. This proportion is much lower in Australia at 18%. Overseas trained doctors provided 51% of GPs in the combined rural and minor urban areas (under 1,000 population), 37.5% in secondary urban areas and 30.2% in main urban areas. The proportion across occupational groups ranged from 14% to 61% (*Appendix – Table 6*).

Countries in which qualifications were obtained by overseas trained doctors were the United Kingdom 38.8%, South Africa 20.6%, Australia 7.6%, India 7.3%, Sri Lanka 6.5%, Iraq 2.1%, Canada 1.7%, Pacific Island countries 1.6%, Eire 1.5%, Germany 1.5%, Hong Kong 1.4%, United States 1.4%. Forty-nine other countries with less than 30 doctors each made up the remaining 7.9%.

Doctors with temporary registration

Doctors visiting New Zealand and not seeking permanent residence may apply for temporary registration for 2-3 years. These doctors were surveyed for the first time in March 1998 and were analysed separately. The estimated number of temporary registrants was 283 or 3.2% of the total active workforce, compared to 1.1% of the 1996 workforce in Australia. The New Zealand figure includes an adjustment for the lower response rate of 76%.

The main employer was clearly Health and Hospital Services (84%), but temporary doctors worked in a variety of roles. Thirty-one percent described their capacity as registrar, 21% as house officer, 20% as specialist and 13% as GP.

The majority of temporary registrants (62%) received their original qualification in the United Kingdom, followed by 15% from South Africa and 8% from the United States. Forty-four percent were women. The average time since initial New Zealand registration was 7.5 months, suggesting that most temporary doctors stay for considerably less than the three year maximum.

Discussion

Response rate and accuracy: Survey results since 1996 have not been adjusted for non-response. The 1998 response rate was 97.2%, up from 95.4% in 1997. Further analysis of registration information for non-respondents suggests that of all working doctors, only 150 did not complete a questionnaire, while 60 were included in results but had left the workforce by 31 March 1997. Allowing for these factors, calculations of the point-in-time workforce (eg, total hours worked) are estimated to be 1% less than the actual total.

Hours worked: The data on hours worked should be treated with some caution, since some doctors may include time spent "on call" but which was not spent doing medical work. For the 1999 questionnaire this distinction has been made more explicit.

Ethnicity: Ethnicity refers to the cultural group or groups people identify with. Multiple responses are reported here as a single category, according to a simplified version of Statistics New Zealand's prioritisation standard.

The proportion recording their ethnicity as Maori fell from 2.5% in 1997 to 2.3%, largely due to individuals changing their previous (1997) response. These changes may have been biased by overprinting of modified 1997 responses on the questionnaire for confirmation. The original single or multiple response were reprinted as the prioritised single category used for statistical analysis. Year to year changes by individuals also highlight the fact that ethnic self-identity can change.

Workforce growth: The workforce survey does not ask why doctors enter or leave the workforce. Registration data for this period is not available, but 1998-99 data shows 253 new practitioners who are New Zealand graduates and 167 who are overseas trained joining the general or probationary register. Over the same period 200 previously active doctors left the workforce, the majority due to net migration, followed by retirement, breaks from the workforce and death.

Workforce trends: The last detailed analysis of medical workforce trends over time was completed for the Clinical Training Agency in 1995. Since then, use of modeling techniques,^{13,14} and supply and demand analysis¹⁵ has continued to advance. A more in-depth study of New Zealand trends than is possible in this supplement would be particularly valuable once data to 2000 is available.

Work by the Medical Council on data series from 1989 will be completed this year, allowing the Council to facilitate longer term study of the medical workforce.

Further information

Additional detailed analysis of this survey is provided by the Medical Council to the Ministry of Health and individual information requirements can be discussed with the analytical unit, New Zealand Health Information Service. A selection of data is also available from the NZHIS website at <http://www.nzhis.govt.nz/stats/medpracstats.html>.

Please address any correspondence about this summary to Greg Waite at the Medical Council (phone 04 381 6784 or email gwaite@mcnz.org.nz).

Acknowledgements

This report was prepared by Greg Waite, information officer for the Medical Council, with assistance from Dr Nick Wilson, public health physician. Professor John Campbell and Dr Graham Harrison provided peer reviews. Angela Pidd of the NZHIS and Nanette Ainge of the CTA also provided useful comments on the draft. Funding to complete this survey is provided by NZHIS.

The Medical Council particularly thanks all the practitioners who took time to complete the workforce survey.

Appendix

Table 6: Demographics of doctors working in the main occupational groups

Capacity/work at main work site	Median age 1998	Percent women			Percent overseas trained		
		1980	1990	1998	1980	1990	1998
House officer	27	32	44	49	27	21	20
Registrar	32	23	29	35	42	22	35
Medical officer special scale	44	38	32	38	52	50	61
Primary care other than general practice	41	49	42	38	42	39	31
Other	44	46	25	29	43	32	31
Specialists and GPs (vocational groups)							
Anaesthetics	46	19	16	18	41	39	43
Basic medical science	48	12	16	30	31	42	40
Dermatology	44	3	17	23	30	20	26
Diagnostic radiology	44	8	14	23	24	27	37
Emergency medicine	39	–	0	31	–	50	46
General practice	42	13	24	35	35	30	34
Internal medicine	47	4	7	15	24	34	32
Obstetrics & gynaecology	46	10	17	28	24	28	45
Occupational medicine	48	–	5	15	–	41	25
Ophthalmology	47	6	11	9	18	16	20
Paediatrics	45	21	23	26	38	39	34
Pathology	47	15	22	24	21	26	38
Primary care	64	0	–	13	0	–	33
Psychiatry	47	19	28	30	41	50	56
Public health medicine & mgmt	44	12	23	29	44	36	26
Radiotherapy	42	–	5	17	–	55	52
Rehabilitation medicine	41	–	–	0	–	–	50
Surgery: cardiothoracic	46	–	–	6	–	–	35
Surgery: general	50	–	–	3	–	–	28
Surgery: neurosurgery	47	–	–	7	–	–	57
Surgery: orthopaedic	46	–	–	4	–	–	15
Surgery: other subspecialties	43	–	–	–	3	–	24
Surgery: otolaryngology	46	0	2	5	31	24	28
Surgery: paediatric	45	–	–	30	–	–	40
Surgery: plastic	51	–	–	3	–	–	14
Surgery: urology	52	–	–	0	–	–	16
Surgery: all except otolaryngology ⁱ	–	0	1	4	20	23	23
Venereology	43	17	50	25	33	50	50
All the above groups	44	16	24	31	33	29	34

ⁱ All surgical subspecialties except otolaryngology were combined in 1980 and 1990 data.

Table 7: Medical workforce by territorial authority of main work site

Territorial authority	Number of GPs	FTEs for GPs at all work sites	FTEs for GPs per 100 000 population	Average total hours for GPs	Number of doctors	FTEs for all doctors per 100 000 popn.	Overseas trained as % of all doctors	Territorial authority Population
Cities								
North Shore City	156	152	82	39	391	231	33	185700
Waitakere City	107	105	63	39	161	95	37	167400
Auckland City	407	399	106	39	1654	510	29	377900
Manukau City	196	195	71	40	537	234	35	277100
Hamilton City	115	120	103	42	530	546	38	115700
Napier City	51	53	97	42	90	186	38	54900
Palmerston North City	66	74	98	45	276	440	38	75000
Porirua City	33	29	60	35	69	143	48	47700
Upper Hutt City	34	32	87	38	36	93	31	37400
Lower Hutt City	69	66	67	38	200	225	30	98500
Wellington City	147	145	87	39	681	7475	25	165900
Nelson City	37	40	97	43	111	310	18	41400
Christchurch City	338	319	99	38	982	353	23	322700
Dunedin City	112	119	99	42	460	464	27	120000
Invercargill City	49	47	91	39	142	309	54	51900
Districts								
Far North District	49	55	99	45	57	119	65	55900
Whangarei District	59	63	90	42	170	284	44	69700
Kaipara District	9	10	58	45	12	75	67	17750
Rodney District	54	60	83	44	56	85	21	72300
Papakura District	34	36	87	43	45	119	20	41600
Franklin District	31	32	63	42	33	66	42	51400
Thames Coromandel District	28	31	118	44	44	189	64	26300
Hauraki District	15	16	90	43	16	94	50	17800
Waikato District	21	23	58	45	22	60	45	40600
Matamata-Piako District	20	21	69	41	20	69	45	29800
Waipa District	27	27	68	41	30	74	63	40100
Otorohanga District	6	8	84	56	6	84	17	9960
South Waikato District	16	18	71	45	20	88	60	25000
Waitomo District	9	11	117	51	12	147	58	9710
Taupo District	24	30	93	50	32	120	38	32400
Western Bop District	24	25	65	41	25	69	20	37700
Tauranga District	89	89	105	40	211	279	30	85000
Rotorua District	53	54	80	41	145	244	37	67200
Whakatane District	27	25	74	37	61	177	57	34100
Kawerau District	7	7	92	41	7	92	86	7750
Opotiki District	6	8	83	54	7	91	71	9750
Gisborne District	30	37	79	49	71	183	46	46700
New Plymouth District	53	54	79	41	164	272	42	68700
Stratford District	8	10	109	51	9	111	44	9420
South Taranaki District	21	22	77	42	25	97	64	28800
Ruapehu District	13	15	86	45	18	114	67	16900
Wairoa District	7	10	102	58	8	116	88	10000
Hastings District	48	52	76	43	137	238	29	68200
Cent. Hb District	8	8	64	42	8	64	75	13100
Wanganui District	39	39	87	40	111	282	63	45300
Rangitikei District	10	11	68	44	11	77	55	16300

Table 7: Medical workforce by territorial authority of main work site – *continued.*

Territorial authority	Number of GPs	FTEs for GPs at all work sites	FTEs for GPs per 100 000 population	Average total hours for GPs	Number of doctors	FTEs for all doctors per 100 000 popn.	Overseas trained as % of all doctors	Territorial authority Population
Districts								
Manawatu District	10	13	44	51	12	51	17	28600
Tararua District	8	11	58	55	8	58	50	18800
Horowhenua District	19	22	72	46	28	100	64	30600
Kapiti Coast District	49	53	131	43	56	149	43	40500
Masterton District	17	17	75	41	44	215	48	23000
Carterton District	1	1	27	24	3	27	1	6760
South Wairarapa District	5	7	77	55	5	77	60	8920
Tasman District	32	32	81	40	37	90	49	39600
Marlborough District	34	34	86	40	64	174	34	39700
Chatham Islands District	0	0	0	0	2	292	1	750
Kaikoura District	6	7	189	45	6	189	67	3590
Buller District	6	7	66	46	7	75	86	10550
Grey District	11	10	68	35	24	189	58	14000
Westland District	5	6	71	47	7	94	71	8380
Hurunui District	8	8	80	39	13	137	54	9740
Waimakariri District	17	18	53	43	18	57	22	34700
Banks Peninsula District	7	7	92	41	8	105	38	7800
Selwyn District	17	17	65	41	19	68	32	26800
Ashburton District	17	23	92	55	29	146	41	25600
Timaru District	29	29	69	41	74	210	36	42800
Mackenzie District	1	1	115	65	3	115	1	4240
Waimate District	1	1	60	61	3	60	1	7620
Waitaki District	19	23	107	48	23	133	43	21500
Cent. Otago District	12	14	96	48	17	133	47	14900
Queenstown-Lakes District	18	20	130	45	19	131	21	15700
Clutha District	14	18	98	51	17	126	47	18100
Southland District	19	17	54	35	21	62	43	30600
Gore District	9	10	73	43	11	87	73	13200
Total	3,159	3,241	85	41	8,491	258	34	3,791,490

¹ To prevent identification of individuals, categories which contain less than 4 doctors are omitted.

References

- Medical Council of New Zealand. The New Zealand medical workforce 1997. MCNewZ Issue 20, April 1998.
- Hannah A, Roser B, Linton M. The New Zealand health workforce 1990. Wellington, Department of Health, 1996.
- New Zealand Health Information Service. The New Zealand health workforce 1994. Wellington: Ministry of Health, 1996.
- New Zealand Health Information Service. New Zealand medical practitioners 1997. Wellington: Ministry of Health, 1999.
- Hannah, A. The New Zealand medical practitioner workforce 1995. Christchurch: Clinical Training Agency, 1996.
- Subnational population estimates: as at 30 June 1998. New Zealand: Statistics New Zealand, 1998.
- Area unit and urban area 1996 concordance file. New Zealand: Statistics New Zealand, 1997.
- Australian Medical Workforce Advisory Committee. Australian medical workforce 1996. Australia: AMWAC, 1997.
- Barnett JR, Laurence M, Higgins C. Where have all the doctors gone? Changes in the geographic distribution of general practitioners in New Zealand since 1975. 1: Regional and urban-rural differences. NZ Med J 1991; 104: 314-316.
- Barnett JR, Laurence M, Higgins C. Where have all the doctors gone? 2: Intra-urban trends: changes in the geographic distribution of general practitioners in Auckland. 1980-1987. NZ Med J 1991; 104: 314-316.
- Australian Medical Workforce Advisory Committee. Female participation in the Australian medical workforce. Australia: AMWAC, 1996.
- Demographic trends 1998. New Zealand: Statistics New Zealand, 1998.
- Hannah, A. Workforce analysis: New Zealand vocationally registered medical practitioners. Christchurch: Clinical Training Agency, 1997.
- Newton S, Buske L. Physician resource evaluation template: a model for estimating future supply in Canada. Annals RCPSC 1998; 31: 145-150.
- Australian Medical Workforce Advisory Committee. Medical workforce supply and demand in Australia: a discussion paper. Australia: AMWAC 1998.