Report

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Oral Health of New Zealand Service Personnel in WW1

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ABSTRACT

Background and Objectives: During the First World War, 10% of New Zealand's population served in the armed forces, and around one in five of those were killed. In commemoration of 100 years since WW1, this study uses retrospective data to report on the oral health of NZ service personnel.

Methods: 325 Pākehā, 165 Māori and 150 Samoan male recruits who served in the NZ Expeditionary Force between 1914 and 1918 were randomly selected and their personnel files accessed through Archives New Zealand.

Results: The oral health of recruits was described as 'good' for 44%, 'pass' for 38%, 'pass with false teeth' for 5% and 'poor' for 13%. Dental health was documented at enlistment for a decreasing proportion of soldiers as the war progressed, dropping from 96% during 1914-15, to 54% in 1916 and 22% in 1917-18 ($p<0.001$). Significantly more soldiers who enlisted in 1917-18 had poor dental health (44%) than those who enlisted during 1916 (20%) and 1914-15 (8%) ($p<0.001$). By ethnicity, Māori had the best dental health, followed by Samoan and Pākehā recruits ($p<0.001$). On average, dental health was poorer among the lower ranks and among recruits of low socio-economic status; and soldiers from major cities had better oral health than those from rural areas; however, these differences were not statistically significant in this sample.

Conclusions: Enlistment criteria appear to have been loosened as the war progressed, perhaps to accept more soldiers into service. Poor oral health was reported for approximately 1 in 7 accepted recruits. Māori appear to have had better oral health.

INTRODUCTION

The First World War (WW1) remains a defining period in the history of New Zealand and established a sense of national identity among the people. It is estimated that 98,950 New Zealanders fought in WW1 (including 2227 Māori and 461 Pacific Island people) – a tenth of the population at the time. By the end of WW1, 18,058 NZ servicemen were killed and 41,317 were wounded (or hospitalised due to illness) – a casualty rate of almost 60 percent (NZ Ministry for Culture and Heritage, 2015). The year 2014 marked the beginning of the WW1 centenary with a number of commemorative events being held throughout NZ and the Commonwealth. It was also the same year that Archives New Zealand digitised and publicised the personnel files of NZ military personnel who served in WW1 (Archives NZ, 2015).

The oral health of NZ men during WW1 is said to have been generally poor, and 35% of otherwise fit volunteers were rejected or deferred at enlistment due to dental problems (Carter, 1916; Hunter, 1923; Brooking, 1980). Initially, the dental examination of recruits was conducted by medical doctors with little to no knowledge of or experience in dentistry, while treatment was carried out by dental officers appointed under the Medical Corps (Hunter, 1923; Anson, 1960). The need for an independent military dental unit with suitably qualified dental personnel was vigorously advocated by Dr Thomas Hunter and Professor Henry Pickerill, which led to the establishment of the New Zealand Dental Corps in November 1915. The New Zealand Dental Association (NZDA) was also very supportive and offered to treat recruits at heavily reduced rates, formally informing the government of their intentions (NZDJ, 1915; Brooking, 1980). As such, New Zealand became one of the first nations to identify and meet the need for the systematic dental treatment of its expeditionary force and was the only one to provide dental services at the Gallipoli landings (Hunter, 1923). The aim of treatment was "a healthy mouth, with a fair amount of masticatory power". Treatment consisted mostly of extraction of teeth, placement of dental restorations and delivery of removable dentures (NZ Army Dental Corps 1915; Winstone, 1916). This care was considered to be of a higher standard than any of NZ's allies and greatly contributed towards reducing the burden of disease and increasing the fighting efficiency among NZ soldiers (Hunter, 1923). The war had served to highlight the poor state of oral health in NZ. In particular, the poor state of oral health among the young men who enlisted was a key driver for the establishment of the School Dental Service in 1921 as a step towards better oral health. This was accompanied by a push to shift the focus of dentistry from extraction to dental restoration and prevention of disease commencing at that time (Brooking, 1980; Schmidt, 2012).

Due to a lack of health surveys or studies at the time, no epidemiological data are available on the oral health of New Zealanders during the First World War. The first epidemiological evaluation to systematically report on the dental status of NZ military personnel was in the 21st century, reported by Logan et al. (2009). The aim of this study was to review and report on the dental health status of NZ WW1 service personnel. It is hoped that this may help gain better insight into the oral health of the NZ population 100 years ago and serve as a timely reminder of the service of the dental profession in improving health during WW1.

METHODS

Ethical approval was granted by the University of Otago Human Research Ethics Committee (reference D15/120) and Māori consultation was undertaken through the Ngāi Tahu Māori Consultation Committee. Publicly available data were used to conduct the research and all personal identifying information was removed.

The study sample consisted of 640 male recruits who served in the New Zealand Expeditionary Force during WW1 between 1914 and 1918. Recruits were selectively sampled into three main groups by recorded ethnicity – Pākehā, Māori and Samoan. 325 Pākehā soldiers were randomly sampled from the main body and reinforcement groups of 'The Nominal Rolls of The New Zealand Expeditionary Force' (NZ Army, 1914-1919), accessed at the Dunedin Public Library. The book 'The Hokowhitu a Tu: The Māori Pioneer Battalion in the First World War' (Pugsley, 1995), was accessed at the University of Otago Central Library and was utilised to randomly select 165 soldiers from the Māori Contingent nominal rolls. An online version of 'The Samoa (N.Z.) Expeditionary Force 1914-1915' (Smith, 1924) was accessed to sample 50 Samoan soldiers who embarked from 1914-1915. As this source did not provide data on recruits who embarked during the latter half of the war, the remaining 100 Samoan soldiers were selected from 'The Nominal Rolls of The New Zealand Expeditionary Force' (NZ Army, 1914-1919) by sampling from only the Samoan contingents which embarked during 1916-1918. IBM SPSS software was used to generate random numbers for the sampling procedure. Most of the study sample was taken from hard copies of nominal rolls by selecting a random body/reinforcement group, a random page assigned to that group and finally a random person on that page. The Samoan 1914-1915 sample was the exception, whereby the electronic list of recruits was transferred into a Microsoft Excel spread sheet and sampled by assigning each recruit a single unique number. Each recruit's digitised personnel file was accessed through the online Archway database of Archives New Zealand (Archives NZ, 2015). Of particular interest were the 'History Sheet' containing generic details such as name, date of birth, age, last NZ address and occupation; and the 'Description on Enlistment Form' containing medical information. The latter contained a single question regarding dental fitness – "What is the condition of the teeth?" Records were allocated into one of the designated categories which were: 'pass – good', 'pass', 'pass with false teeth', 'illegible', 'not recorded', 'no option on form' and 'form not found.' Table 1 indicates how the unique responses were classified. In 1917, the 'Description on Enlistment' form began to be replaced by the 'Medical Examination Form'. The latter did not contain a dental fitness related question, hence the category 'no option on form.' It must be noted that a 'Dental History and Examination' form also started appearing in 1917. This allowed for a more comprehensive record of the recruit's dental status and treatment needs, and was evaluated whenever present.

The Elley-Irving Socio-Economic Index (Elley & Irving, 1972) was utilised to categorise the recruits into high, medium and low socio-economic status (SES) based on their occupation prior to enlistment. The last NZ address of recruits was classified into 'urban' or 'rural' categories based on whether it was located within the major urban cities at that time (Auckland, Wellington, Christchurch or Dunedin) or elsewhere. The recruits were also divided into 3 groups based on their rank in the expeditionary force. Higher ranks such as captain, lieutenant, major and reverend were included in the 'officers' category; corporal, lance-corporal, sergeant and bombardier in the 'non-commissioned officers' category; and the lower ranks such as driver, private, trooper, gunner, sapper, bugler and cook in the 'other ranks.'

Table 1 Categorisation of Dental Responses

Dental Health Codes	Responses
Pass–Good	Very Good, Good
Pass	Satisfactory, Sufficient, Pass, Efficient, Sound, Yes, Fit, Normal, Fairly Good, Tick
Pass – False teeth	Artificial, False teeth, Denture
Poor	Unsound, Bad, Deficient, Defective, A number of missing and carious teeth, Faulty, Require attention, Further treatment required before deemed fit
Form not found	Digital file not found, Form not available
Not recorded	Dental-related question on form left blank/unanswered
No option on form	Form does not contain any dental-related question

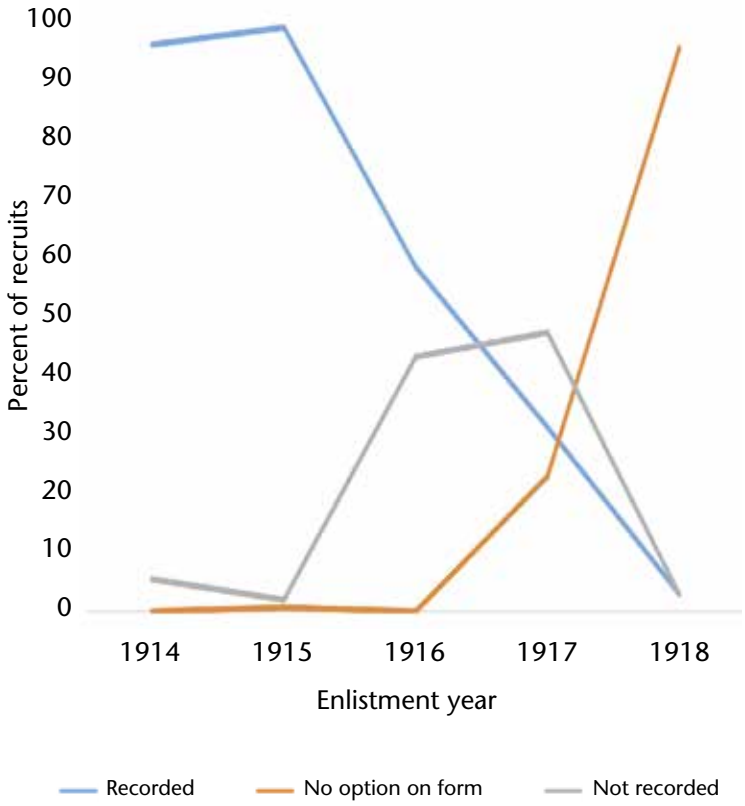
Table 2 Demographic characteristics of study sample

Characteristic	N	%
Ethnicity	325	50.8
Pākehā	165	25.9
Māori	150	23.3
Samoan		
Enlistment Year	129	20.2
1914	158	24.7
1915	127	19.8
1916	146	22.8
1917	34	5.3
1918	46	7.2
Not recorded/Not found		
Age		
21 or under	151	23.6
22 to 25	183	28.6
26 to 30	109	17.0
31 or over	153	23.9
Missing	44	6.9
Rank		
Officers	27	4.2
Non-commissioned officers	103	16.1
Others	510	79.7
Address		
Rural	373	58.3
Urban	254	39.7
Not recorded/Not found	7	1.9
Illegible	1	0.2
Occupation level		
1 (high SES occupation)	34	5.3
2	110	17.2
3	84	13.1
4	94	14.7
5	100	15.6
6 (low	206	32.2
Unclassified	7	1.1
Not recorded/Not found	5	0.8

Table 3 Results

	Pass-Good	Pass	False teeth	Poor
Ethnicity				
Pākehā	38.9	38.3	7.8	15.0
Māori	63.0	22.0	3.0	12.0
Samoan	29.9	55.8	2.6	11.7
Enlistment Year				
1914/1915	51.5	34.5	5.7	8.3
1916	24.6	50.8	4.9	19.7
1917/19118	15.6	37.5	3.1	43.8
Rank				
Officers	60.0	33.3	0.0	6.7
Non-commissioned officers	48.4	38.7	4.8	8.1
Others	41.8	37.5	5.7	15.0
SES				
High	47.0	31.3	8.4	13.3
Medium	43.6	44.6	3.0	8.9
Low	41.4	36.7	5.3	16.6
Address				
Urban	37.2	49.0	4.1	9.7
Rural	48.1	29.5	6.2	16.2
Age				
Under 25	47.7	36.2	3.5	12.6
Over 25	38.6	39.2	7.6	14.6
Total	43.7	37.5	5.3	13.5

Figure 1 Proportion of soldiers whose dental condition was documented/not documented upon enlistment



All research data were electronically entered into a Microsoft Excel spreadsheet and subsequently imported into IBM SPSS for further statistical analyses. The χ^2 test was used to investigate statistical significance of associations between categorical variables.

RESULTS

By ethnicity, 50.8% of the sampled recruits were Pākehā, 25.9% Māori and 23.3% Samoan (Table 2). Most recruits in the sample were enlisted between 1914 and 1917, while 5.3% were enlisted in 1918 and the enlistment year for 7.2% of recruits was unknown (Table 2). One in five of sampled recruits were classified as officers or non-commissioned officers, with the remainder holding other ranks. The last NZ address was urban for 39.7% of the sample and rural for 58.3%. 52% of the sample was under 25 years of age at enlistment and 40.9% over. After exclusion of unspecified and illegible responses, dental health was categorised as 'pass – good' for 43.7% of recruits, 'pass' for 37.5%, 'pass with false teeth' for 5.3% and 'poor' for 13.5%

The proportion of soldiers whose dental health was documented upon enlistment decreased as the years progressed (Figure 1), dropping from 96.2% for the years 1914-15 to 53.5% in 1916 and 21.7% in 1917-18 ($p<0.001$). From 1916 onwards, the number of not recorded responses increased and with the introduction of the new 'Medical Examination Form' in 1917, the number of records for which the form included no dental option also grew. The 'Dental History and Examination Sheet' also started appearing in 1917, but was found for only 9 recruits in our sample. On average, better dental health was found among recruits who enlisted during the initial years of the war than those enlisted towards the end of the war. 8.3% of recruits enlisted during 1914-15 had poor oral health, rising to 19.7% in 1916 and 43.8% in 1917-18 ($p<0.001$).

Proportionally more Māori recruits had good oral health (63.0%), than Pākehā (38.9%) and Samoan (29.9%) recruits ($p=0.001$). Furthermore, poor oral health among Pākehā recruits (15.0%) was more prevalent than among Māori (12.0%) and Samoan (11.7%) recruits ($p=0.685$). 6.7% of higher ranking officers, 8.1% of non-commissioned officers and 15.0% of other lower ranked recruits had poor dental health ($p=0.257$). Proportionally more low SES recruits had poor dental health (16.6%), than high (13.3%) and medium (8.9%) SES recruits ($p=0.205$). 16.2% of recruits from rural areas and 9.7% of recruits from major cities had poor dental health ($p=0.177$); and 12.6% of recruits aged 25 years or under had poor dental health, with the proportion being similar in those aged over 25 years at 14.6% ($p=0.583$). Note that these proportions were calculated after eliminating the unknown and illegible responses in each variable category.

DISCUSSION

From 1916 onwards, examiners increasingly began to leave the "What is the condition of the teeth" option blank, whereas in 1917, the new 'Medical Examination' form appeared which did not have an option to record dental information at all. The comprehensive 'Dental History and Examination Sheet' also started appearing in the same year and NZDA-issued statements in the NZ Dental Journal advised examiners how to systematically fill in this form. Unfortunately, the form was

hardly used or often filled out inconsistently when it was used (NZ Army Dental Corps, 1915; Pickerill, 1916). Dental problems were a significant cause for the rejection of otherwise fit recruits during the initial stages of the war, but as the war progressed the proportion of soldiers whose dental status was reported decreased. One possible reason could have been the lowering of dental fitness standards towards the latter years in order to accept more recruits to meet the demands of the war. Conscription was also introduced in August 1916 (as opposed to voluntary enlistment) in order to maintain force numbers. Furthermore, the proportion of enlisted soldiers with poor dental health increased as the war progressed, again suggesting lowering dental standards. This lack of accurate information on the oral health of recruits not only served to hide poor dentition but also led to situations where soldiers were called to dental camps to receive treatment which had already been completed but not recorded. The result was an unnecessary waste of time and resources for the dentist but also valuable training time for the soldier (Pickerill, 1916). There have been major improvements in the documentation of NZ military dental records as compared to 100 years ago, and since 1992, the NZ Defence Force has implemented standardised electronic recording of personnel dental records, enabling easier accessibility and manipulation of the data (Logan et al., 2009).

The overall proportion of soldiers in the study sample with poor dental health was 13.5%. However, a number of NZ men were rejected from enlisting on account of dental problems and their records unavailable. As such, the true proportion of poor dental health among NZ men 100 years ago is expected to have been greater than we report; however, as no data are available for the rejected candidates it is not possible to estimate this.

Proportionally more recruits who were of low SES had poor dental health than the rest of the sample. This was similar for the lower ranking recruits, however these differences were not statistically significant. A soldier's rank correlated with their socio-economic background with the lower ranks generally consisting of young soldiers with low SES or education, and higher ranking officers being professionals with higher school/university education or landed gentry (Razzell, 1963; Sheffield, 2000). The correlation between low SES and poor dental health is a well-established one (Jamieson & Thomson, 2006), reinforced by these observed gradients.

We identified that the oral health of Māori recruits was better than non-Māori recruits, on average. This is consistent with historical reports of Māori dental health, as recently as the late 1940s (Hewat & Eastcott, 1956). For example, Māori oral health was so good that Pickerill believed that pre-European Māori were "the most immune race to caries", and that this was due to dietary factors (Pickerill, 1912). Although the causation for dental decay is in the main, dietary factors, for Māori at that time there were other significant contributing factors for their good dental health. Our findings contrast starkly with the direction of dental health inequalities today, whereby poorer dental health is now found among Māori than among non-Māori, a health inequality that is now well-established (Ministry of Health, 2010).

A number of unique and often brief responses were used to describe the recruit's dental health. These were designated into self-produced categories in order to facilitate data analysis. It was attempted to form and follow the dental status classification system as accurately as possible with the given raw data. There was also a high proportion (44.3% of total responses) of not recorded/not assessed dental responses which were removed from the data prior to final analyses.

Some responses to the "What is the condition of the teeth" question contained extra dental information which can help gain a better understanding of what 'Good' or 'Fair' meant to the examiners at the time. For example, 'Good' was associated with specific details such as *"some molars gone", "artificial", "2 missing", "false front upper",* and *"good but needs clearing."* 'Fair' was used to describe individuals with "*stumps*" and "*2 removals required*." The descriptions are limited, but it is not possible to obtain similar information elsewhere; rendering these military records a valuable source of information on dental health from 100 years ago.

CONCLUSION

The dental health of the armed forces was a matter of great interest to the dental profession at the time of the First World War. Some 100 years after the war, it is timely to remember the service of our past dental colleagues in maintaining the dental health of New Zealand soldiers. Our findings suggest that dental status was recorded upon enlistment for a decreasing proportion of soldiers as the war progressed. The proportion of recruits with poor dental health also increased with each passing year – suggesting lowering dental standards for enlistment in the expeditionary force. By ethnicity, Māori recruits had the best oral health. Overall, the dental records were limited and often incomplete, and oral health standards at the time generally low.

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