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Research Article

Virtual Outpatient Clinics help Address Inequities in Healthcare Access

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ABSTRACT

Background: Common orthopaedic fractures require outpatient clinic follow-up. In-person clinic demand traditionally tends to exceed capacity, the impact of which falls most heavily on communities of low Socioeconomic Status (SES); especially Māori and Pacific Island communities. The Virtual Fracture Clinic (VFC) is a form of telemedicine that has been successfully adopted internationally. The utility of the VFC model remains unmeasured in New Zealand, and its socioeconomic impact in low SES, unknown.

Methods: We performed an audit of 18,235 fracture clinic patient encounters from 2014 to 2020, spanning a period prior to, including and following the COVID-19 lockdown. Inclusion criteria involved all new referrals from regional Accident and Emergency clinics, Emergency departments and primary care (GP practices). The primary outcome was monthly clinic attendance and DNA (did not attend) rates when comparing traditional 'in person' versus a VFC system involving phone and video consults. The secondary measure was the cost savings associated with VFCs.

Results: DNA rates decreased following the implementation of VFCs during level 4 lockdown and post-lockdown in 2020. Furthermore, when comparing the mean monthly percentage of pre-2020 clinic attendances across the 2014-2019 financial years to VFCs operating during and post-lockdown, DNAs decreased from 10.7% to 6.0%. Lower SES communities saw improvements in DNA rates from 25.6% to 12.5% for Māori and 20.9% to 16.7% respectively for Pacific Island communities when comparing pre-2020 clinic attendances with VFCs. These represent potential savings of up to $6,840 per clinic.

Conclusion: We demonstrate a simple model to help address inequities of healthcare access to outpatient services for Maori and Pacific Island communities in New Zealand. This study supports the use of the VFC model in standard practice to improve clinic efficiency, reduce DNA rates and provide cost savings.

INTRODUCTION

Orthopaedic fractures requiring outpatient clinic follow-up are common. Under the traditional model of in-person clinics, demand often exceeds capacity with the burden tending to fall on our Māori and Pacific Island communities of low Socioeconomic Status (SES) [1]. Ineffective use of appointments and Did Not Attend (DNA) clinic rates also place a financial load on healthcare providers. Virtual clinics, also known as video-consultations, are a telemedicine that delivers healthcare through communications technology. Developed countries with similar outpatient capacity pressures have demonstrated the benefit of virtual clinics, especially necessitated by the COVID-19 pandemic. The impact of such telemedicine on New Zealand's orthopaedic outpatient clinics and, in particular, the effect on different population demographics remains unmeasured. To our knowledge this is the first study to measure these effects. The New Zealand Ministry of Health's (MoH) most recent annual survey for the year ended June 2019 states that 21–27% of New Zealanders are expected to be aged 65+ by 2050 [2]. Against the backdrop of the epidemiological transition, Musculoskeletal (MS) conditions comprise 13% of long-term conditions which constitutes 87% of total Disability- Adjusted Life Years (DALYs) [3]. This burden is borne inequitably, with Māori being 1.26 times more likely to experience chronic pain and 1.27 times more likely to have arthritis than non-Māori [3]. Encompassing 25% of New Zealand's total annual health costs equating to at least $5.57 billion a year, MS conditions are predicted to continue growing due to their direct relation to ageing and further exacerbation by increasing rates of obesity, Cardiovascular Disease (CVD) and osteoporosis [4], (Table 1).

Table 1: Prevalence of key musculoskeletal conditions and procedures [2-4].

Year	Population Projections	Arthritis	Osteoporosis	Fracture load	MS operations	Primary hip replacements
2001	3,880,500	920,000	380,062	109,454	47,990	4,911
%		23.71	9.79	2.82	1.24	0.13
2015	4,352,700	1,084,000	451,427	110,683	52,143	6,778
%		24.9	10.37	2.54	1.2	0.16
2030	4,698,300	1,237,000	675,694	107,899	56,346	8,983
%		26.33	14.38	2.3	1.2	0.19
2051	4,806,500	1,374,000	764,268	118,594	62,580	9,718
%		28.59	15.9	2.47	1.3	0.2

Previous international studies have shown, on average, a positive financial impact. The University Hospital of North Norway conducted an economic evaluation of virtual orthopaedic clinics which demonstrated cost-effectiveness from both a societal level of annual cost savings as well as a health perspective using Quality-Adjusted Life Years (QALYs) [5,6]. The cost-effectiveness and efficiency of virtual orthopaedic clinics overseas has shown to come with no inferiority in health outcomes [6-11]. The UK Virtual Fracture Clinic (VFC) model has reduced outpatient appointments by approximately 50% and saved the NHS over £250,000 a year [12]. In the setting of the COVID-19 crisis, the Department of Orthopaedic Surgery at the Johns Hopkins University School of Medicine suggested that complementing live visits with telehealth can allow providers to achieve up to 50% of their typical clinical volume within 2 weeks [3]. Such virtual care provided has been shown to be safe and without serious adverse events [10] while also increasing patient satisfaction through reduced time and cost burden for patients and carers [6,11,13]. While virtual orthopaedic clinics can also have an equitable impact by decreasing financial, time and geographic barriers, an Australian study centring rural and remote communities cautions that disadvantaged populations and the health professionals that serve them face greater barriers to uptake due to comparatively less adeptness with technology use and poor internet access [14].

METHODS

18,235 patient encounters were reviewed in the Auckland City Hospital (ACH) outpatient fracture clinics from July 2014 to May 2020 with demographic breakdown based on self-reported ethnicity. The 2020 data includes the COVID-19 New Zealand level 4 'lockdown' period (Table 2) and the associated move to the VFC which ran across March 26 through to May 27 2020; during and post-lockdown. The post-lockdown period operated at levels 3 and level 2 which involved the easing of restrictions on public gatherings and movement and includes the return to regular clinic usage. This provides a unique data series to assess the impact of VFCs by including data before, during and after its implementation. Inclusion criteria involved all new referrals from the ED and community GPs to the fracture clinic. No patients were excluded.

Table 2: COVID-19 governmental alert level dates for the 2020 financial year [15].

COVID-19 Alert Level	Date Start	Date End
Level 4 ('lockdown')	26 March	27 April
Level 3	28 April	13 May
Level 2	14 May	8 June
Level 1	9 June	-

The primary outcome measure of the study was the difference in monthly DNA clinic rates between a traditional in-person system versus a virtual clinic system. The secondary measure was the overall net-cost impact associated with VFCs, which was reviewed in collaboration with health economists. With fracture clinics being the busiest clinic type for the orthopaedics department at ACH, a virtual clinic system was introduced during COVID-19 initiated level 4 lockdown in March when only essential service movements were allowed nationwide. This virtual clinic system was continued for 1 month following the level 4 lockdown at which point there was a concurrent reversal back to traditional in-person clinics.

The ED and GPs provided clinic staff with patient notes and imaging for referrals in the preceding 24 hours. Each new patient referred to the clinic had their case and imaging reviewed by a consultant orthopaedic surgeon. An appointment was then scheduled for the patient to be seen either in-person, virtually (via phone or video), or returned back to the GP. To limit in-person clinic visits, in-person consultations were limited to the following: immediate post-operative visit for suture removal (when not able to be removed elsewhere or resorbable sutures are not used); fracture reduction check for non-operatively managed fractures that had a reduction and splint or cast applied; new acute fractures; patients with concern for complications; and patients with a potential weight-bearing status change that requires x-rays and/or cast removal before decision-making [16]. Furthermore, when feasible for this last subset of patients, x-rays were performed local to their home with subsequent review and treatment recommendations provided during a virtual clinic in order to eliminate the need for an in-person clinic visit. Letters of these discussions and recommendations were provided to community/family doctors and local physiotherapists. Data analysis was performed using Excel software involving both descriptive and inferential statistics. DNAs were calculated as a percentage of all 'patient encounters' or referrals made whether attended or not. Monthly clinic attendances and DNAs were compared by calculating the mean of the total attendances and DNAs in two groupings as stratified by ethnicity as well as overall: 2017 to 2019 versus during and after the 2020 lockdown (level 4 lockdown to post-lockdown 2020). Standard t-Tests were then used to determine statistical significance of two-sample assuming unequal variances.

RESULTS

While VFCs were operating at less than a third of capacity during the COVID-19 level 4 lockdown period (79 VFC attendances) when compared to pre-2020 clinics within the 2014-2019 financial years (233 monthly average in-person clinic attendances), post-lockdown VFCs recovered to near normal capacity (224 VFC attendances) (Table 3). Following the implementation of the VFCs during and post-lockdown, the DNA rates of encounters for Māori, Pacific, Asian and Other ethnicities decreased with the implementation of VFCs. Only in Europeans did DNA clinic rates increase (Table 5). When comparing pre-2020 mean monthly percentages to virtual clinic operations during and post-lockdown 2020, DNAs decreased from 10.7% to 6.0% (p-value 0.2801) (Table 5).

Table 3: Total yearly and mean monthly ACH fracture clinic attendances by ethnicity 2015-2020.

Ethnicity	2015	2016	2017	2018	2019	Pre-lock down 2020	Lock-down 2020	Post-lock down 2020
European	1793	1980	1743	1771	1723	1399	45	40
Māori	207	183	192	171	186	117	6	134
Pacific	215	223	224	179	185	115	5	20
Asian	454	574	495	452	451	403	15	18
Other	106	107	106	157	94	147	8	12
Total Yearly Attendances	2775	3067	2760	2730	2639		2484	
Mean Monthly Patients	231	256	230	228	220		207	

Table 4: Total yearly and mean monthly ACH fracture clinic DNAs by ethnicity 2015-2020.

Ethnicity	2015	2016	2017	2018	2019	Pre-lock down 2020	Lock-down 2020		Post-lock down 2020
European	147	156	156	162	183	44		3	8
Māori	64	65	58	65	71	20		2	0
Pacific	68	46	46	47	64	25		2	1
Asian	46	57	29	28	38	12		0	0
Other	7	11	12	17	19	8		0	0
Total Yearly Attendances	332	335	301	319	375	125			
Mean Monthly Patients	28	28	25	27	31	10			

Table 5: Percentage of DNAs of all patient encounters at ACH fracture clinics by ethnicity 2015-2020.

Ethnicity	2015	2016	2017	2018	2019	Pre-level 4 lockdown 2020	Lockdown	Post-lock down 2020	P-value (pre 2020 vs VFC)
European (%)	7.6	7.3	8.2	8.4	9.6	3.0	6.3	16.7	0.6463
Māori (%)	23.6	26.2	23.2	27.5	27.6	14.6	25.0	0.0	0.4850
Pacific (%)	24.0	17.1	17.0	20.8	25.7	17.9	28.6	4.8	0.7831
Asian (%)	9.2	9.0	5.5	5.8	7.8	2.9	0.0	0.0	0.0006
Other (%)	6.2	9.3	10.2	9.8	16.8	5.2	0.0	0.0	0.0038
Total DNAs (%)	10.7	9.8	9.8	10.5	12.4	4.8	8.1	3.9	0.2801

While Māori and Pacific Island communities continued to have the highest proportion of DNAs compared to other ethnic groups throughout the study period, both groups saw a percentage decrease post-implementation of VFCs. Comparing the mean monthly percentage of DNAs for Māori communities pre-2020 to virtual clinic operations during and post-lockdown saw a reduction from 25.6% to 12.5% respectively (p-value 0.4850) (Table 5). For Pacific Island communities, the reduction was from 20.9% to 16.7% (p-value 0.7831) (Table 5).

Table 6: Yearly percentage change of DNAs of all patient encounters at ACH fracture clinics by ethnicity 2015-2020.

Ethnicity	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020 - Post-lock down 2020
European	-3.6	12.5	2.0	14.6	-68.2	446.6
Māori	11.0	-11.5	18.7	0.3	-47.2	-100.0
Pacific	-28.8	-0.4	22.1	23.6	-30.5	-73.3
Asian	-1.8	-38.7	5.4	33.2	-62.8	-100.0
Other	50.5	9.1	-3.9	72.1	-69.3	-100.0
Total DNAs	-7.8	-0.1	6.4	18.9	-61.5	-100.0

Table 7: Cost comparison between traditional and virtual clinics.

Traditional Clinic		Virtual Clinic	
Patient	**Total Cost**	**Patient**	**Cost savings**
1	$360.00	6 discharged without needing to be seen	$2,160
24	$8,640.00	13 patients phoned	$4,680
		5 patients seen	$1,800
		Total savings	**$6,840**

Finally, a cost review demonstrates that, on average, VFCs offer potential savings of up to $6,840 per clinic. An itemised cost listing is shown in Table 8. With a standard clinic featuring 24 patients, traditional in-person model costs an average of $8,640 to cover resources and expenses. In comparison, a review of a standard virtual clinic demonstrated that only 5 out of 24 patients needed to be seen in-person with the remainder eligible for phone consults or discharge without needing to be seen. This shift in resources meant that VFCs, on average, showed a potential cost reduction of $1,800 per standard clinic (Table 7; Table 8).

Table 8: Cost breakdown of traditional clinic.

Item per patient	Average cost
Laboratory total	$1.99
Medical total	$162.59
Clinical support staff total	$0.69
Treatments total	$7.05
Outpatient clinics total	$124.59
Pharmacy total	$1.55
Pharmacy cancer treatment total	$8.23
Radiology total	$54.08
Total cost per patient	$360.77

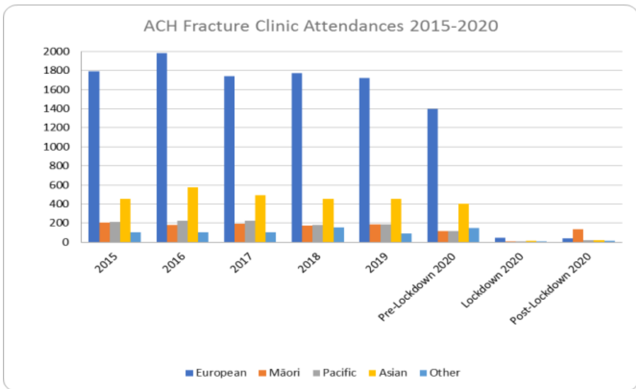

Figure 1: ACH fracture clinic attendances by ethnicity 2015-2020.

DISCUSSION

With current financial and staffing pressures faced by orthopaedic departments in New Zealand hospitals, the status quo appears unsustainable. Numerous international authors have explored the advantages of VFCs and how the COVID-19 pandemic has grown both the need and willingness to continue adopting virtual means of healthcare delivery [5-14]. Regardless of population demographics bar the European group, this data reveals fewer DNA clinic rates all-round (Table 5, Table 6) as well as potential cost reductions of up to $6,840 per standard 24-patient clinic through virtual screening and appropriate triaging of patients (Table 7). Notably, the historically disadvantaged Māori and Pacific Island communities - who have continuously demonstrated the highest DNA rates of all ethnic groups - were shown to benefit from the virtual clinic system (Table 5, Table 6). In moving forward, however, it is important to note that Māori (20%) and Pacific (17%) communities are overrepresented in experiencing the digital divide and may thus be inequitably disadvantaged by the digital transformation of health clinics [17]. Furthermore, these groups may also not be accepting of virtual clinics and telemedicine due to a preference for kanohi ki te kanohi (face to face) interactions [18]. Further work is needed to address this potential area of introduction and standardisation of virtual clinics.

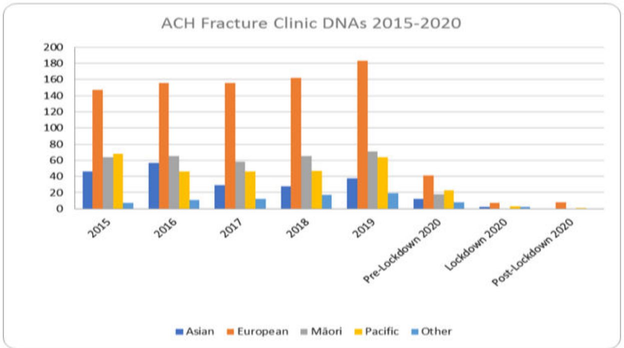

Figure 2: ACH fracture clinic DNAs by ethnicity 2015-2020.

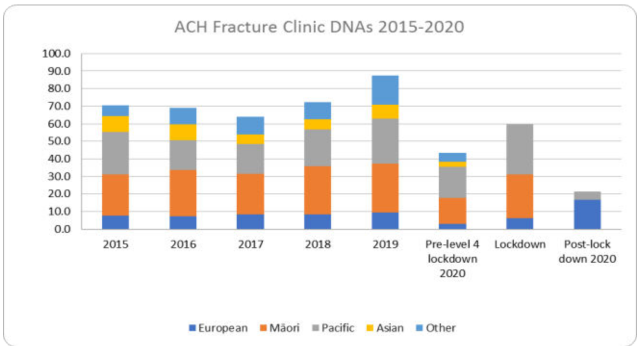

Figure 3: Percentage of DNAs of all patient encounters at ACH fracture clinics by ethnicity 2015-2020.

Limitations of conducting the study through the COVID-19 lockdown includes the potential for artificially low DNA clinic rates surrounding restrictions placed on acute inpatient admissions and more free time for patients to attend clinics in any form due to restrictions placed on work (Table 3). To mitigate this, the clinical encounters for the month of May post-lockdown following the national move to levels 2 and 3 has been the key data used to compare against mean monthly attendance and DNAs of previous years (Table 4). This has shown sustained results, and improvements in the overall DNA rates following the removal of national restrictions to individual movements whilst simultaneously continuing the telehealth model of care, however ongoing evaluation of this is needed. Secondly, whilst this study has demonstrated quantitative gains around telemedicine, it does not address patient experience of the virtual clinic system. We recommend that further studies analyse such qualitative data that gleans insight into how connecting virtually with health professionals affect patient satisfaction and quality of care, as well as investigating the complications associated with the service redesign. Overall, this study demonstrates that a virtual clinic system in standard practice would be beneficial given the wider societal, economic, and environmental impacts of reducing unnecessary traditional in-person clinic attendances. While quantifying such impact is beyond the scope of this project, we suggest that there is significant potential for socio-economic and environmental gain upon the national adoption of virtual clinics. The study adds valuable information to the limited literature regarding the advantageous impact of a virtual clinic system. To our knowledge, this is the first study in New Zealand to address how virtual clinics can address the disproportionate overrepresentation in DNA rates for ethnic minorities and lower SES groups - particularly our Māori and Pacific Island communities. Further studies are required to investigate whether similar results are reproducible across other health specialties and regions.

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