

Table 1: Comparing surgery type, rurality, and health authority distribution between immigrants and non-immigrants who underwent elective general surgery procedures from 2013 to 2021.

	Immigrants	Non-immigrants
Number of Surgeries	22,742 (14.3%)	136,409 (85.7%)
Most Common Surgeries		
Cholecystectomy	31.9%	Cholecystectomy 23.8%
Hernia Repair	11.2%	Hernia Repair 20.0%
Hemorrhoidectomy	9.5%	Colectomy 9.5%
Breast Surgery	7.4%	Breast Surgery 7.5%
Colectomy	5.3%	Hemorrhoidectomy 6.8%
Rurality		
Metropolitan	17,494 (76.9%)	54,429 (39.9%)
Urban	3,978 (17.5%)	49,817 (36.5%)
Rural	1,047 (4.6%)	25,903 (19.0%)
Remote	189 (0.8%)	6,074 (4.5%)
Missing	34 (0.2%)	186 (0.1%)
Health Authority		
Vancouver Coastal	7,751 (34.1%)	22,783 (16.7%)
Fraser	12,142 (53.4%)	45,588 (33.4%)
Island	1,099 (4.8%)	30,361 (22.3%)
Interior	1,327 (5.8%)	26,604 (19.5%)
Northern	389 (1.7%)	10,887 (8.0%)
Missing	34 (0.2%)	186 (0.1%)

Table 2: Demographic information comparing immigrants vs non-immigrants who underwent elective surgeries from 2013 to 2021. Ethnicity based on last country of residence.

	Immigrants	Non-immigrants
Age (\pmSD)	53.1 (\pm 14.1)	59.3 (\pm 15.2)
Sex (%Female)	53.4%	56.8%
Charlson Comorbidity Index (\pmSD)	0.71 (\pm 1.77)	0.85 (\pm 1.91)
Ethnicity		---
Visible Minority	15,431 (67.9%)	---
Caucasian/European	5,879 (25.9%)	
Missing	1,432 (6.3%)	---

Table 3: Comparison of mean wait times for elective surgeries for immigrants and non-immigrants, stratified by rurality and health authority. Wait times measured in days.

	Wait Time in Days				P-value
	Immigrants		Non-Immigrants		
	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)	
Entire Cohort					
All Surgeries	83.7 (± 81.2)	53 (±92)	76.3 (± 76.7)	47 (±82)	<0.01
Cholecystectomies	90.1 (± 80.7)	64 (±95)	74.7 (± 80.7)	51 (±73)	<0.01
Hernia Repair	104.9 (± 83.7)	80 (±116)	99.9 (± 83.7)	75 (±107)	0.01
Stratified Analysis by Rurality					
Cholecystectomies					
Metropolitan	92.6 (± 81.6)	66 (±96)	85.6 (± 75.5)	62 (±83)	<0.01
Urban	83.0 (± 78.1)	56 (±81)	68.0 (± 64.5)	47 (±65)	<0.01
Rural	81.9 (± 77.4)	54 (±97)	69.5 (± 70.8)	44 (±68)	<0.01
Remote	68.8 (± 64.9)	53 (±63)	70.6 (± 69.2)	48 (±71)	0.86
Hernia Repair					
Metropolitan	107.3 (± 83.9)	84 (±116)	108.2 (± 85.2)	84 (±115)	0.71
Urban	97.7 (± 84.4)	67 (±112)	96.7 (± 80.8)	72 (±103)	0.83
Rural	94.7 (± 79.9)	72 (±104)	89.4 (± 83.7)	60 (±98)	0.53
Remote	111.1 (± 79.7)	91 (±109)	97.1 (± 84.3)	69 (±108)	0.39
Stratified Analysis by Health Authorities					
Cholecystectomies					
Vancouver Coastal	97.8 (± 84.9)	70 (±113)	86.7 (± 78.9)	61 (±89)	<0.01
Fraser	87.0 (± 78.8)	62 (±86)	73.0 (± 66.5)	53 (±69)	<0.01
Island	93.9 (± 78.8)	71 (±96)	75.9 (± 71.0)	52 (±73)	<0.01
Interior	83.1 (± 79.9)	52 (±88)	73.5 (± 71.3)	48 (±77)	0.03
Northern	74.4 (± 74.3)	47 (±81)	65.8 (± 68.7)	42 (±60)	0.19
Hernia Repair					
Vancouver Coastal	111.7 (± 86.5)	90 (±126)	102.3 (± 83.8)	76 (±108)	<0.01
Fraser	100.3 (± 81.1)	76 (±105)	97.4 (± 78.8)	76 (±99)	0.29
Island	104.4 (± 83.4)	84 (±114)	108.0 (± 87.6)	84 (±117)	0.62
Interior	107.6 (± 86.3)	84 (±124)	99.2 (± 85.4)	71 (±115)	0.27

Northern

76.7 (\pm 78.6)

41 (\pm 71)

80.6 (\pm 82.5)

50 (\pm 80)

0.82

Table 4: Rate ratios for comparison of wait-times between immigrants and non-immigrants in British Columbia, adjusting for patient and hospital-level variables.

	Rate Ratio	95% Confidence Interval
All General Surgery Procedures	1.03	1.01-1.05
Cholecystectomies	1.08	1.05-1.11
Hernia Repairs	0.99	0.95-1.03
Sensitivity Analysis: Using Surgical Patient Registry Wait Times		
All General Surgery Procedures	1.03	1.02-1.05
Cholecystectomies	1.10	1.08-1.13
Hernia Repairs	1.02	0.98-1.06
Restricted Analysis: Metropolitan & Urban Hospitals		
All General Surgery Procedures	1.03	1.01-1.05
Cholecystectomies	1.09	1.06-1.11
Hernia Repairs	0.99	0.95-1.03
Restricted Analysis: Vancouver Coastal Health & Fraser Health Regions		
All General Surgery Procedures	1.04	1.02-1.05
Cholecystectomies	1.08	1.05-1.11
Hernia Repairs	1.00	0.96-1.04

Appendix 1: Mean surgical wait-times by year of surgery.

Year of Surgery	N	Immigrant		Non-Immigrant		P-Value
		Mean	Median	Mean	Median	
2012	16933	54.7 (\pm 51.2)	37 (\pm 52)	50.5 (\pm 50.8)	33 (\pm 46)	0.01
2013	15712	77.8 (\pm 76)	50 (\pm 83)	71.2 (\pm 73.5)	43 (\pm 73)	0.01
2014	15917	82.5 (\pm 81.8)	50 (\pm 91)	75.8 (\pm 77)	46 (\pm 82)	0.01
2015	15663	79.4 (\pm 79.2)	50 (\pm 83)	74.6 (\pm 74.3)	47 (\pm 80)	0.01
2016	15895	81.4 (\pm 78.4)	53 (\pm 95)	74.2 (\pm 72.4)	48 (\pm 77)	0.01
2017	16226	79.4 (\pm 75.8)	51 (\pm 83)	73.8 (\pm 73.3)	48 (\pm 76)	0.01
2018	16150	79.1 (\pm 74.3)	54 (\pm 82)	73.5 (\pm 70.9)	48 (\pm 75)	0.01
2019	15954	114.9 (\pm 94.1)	90 (\pm 146)	110.6 (\pm 92.2)	87 (\pm 137)	0.07
2020	5264	285.2 (\pm 47.2)	282 (\pm 80)	278.1 (\pm 47.4)	275 (\pm 77)	0.07
2021	16933	54.7 (\pm 51.2)	37 (\pm 52)	50.5 (\pm 50.8)	33 (\pm 46)	0.01

Appendix 2: List of Canadian Classification of Health Interventions codes used to identify General Surgery Procedures.

Procedure	CCI Codes
Rectal Prolapse	1NQ74SS,"1NQ74DW","1NQ74VT","1NQ74EJ","1NQ74TV","1NQ74ED","1NQ74PC","1NQ74BN","1NQ74PE","1NQ74PD","1NQ74BA"
Fistulotomy	"1NQ86MB","1NQ86MBXXL","1NQ86MBXXE","1NQ86MBXXF","1NQ86MBXXG","1NQ86MBW3","1NP86MB","1NP86MBXXA","1NP86MBXXF","1NP86MBXXE","1NP86MBXXG","1NP86MBW3","1NT86MB","1NT86MBFA","1NT86MBW3","1NT86MBXXG","1NT86MBXXL","1NP86MBXXA","1NP86MBXXF","1NP86MBXXE","1NP86MBXXG"
Perianal/Rectal Abscess	1NQ52LA,"1NQ52HA","1NQ52LATS","1NQ52HATS","1NT52HA","1NT52LA","1NT52LATS"
Sphincterotomy/Anal Repair	1NT72LA,"1NT80LA","1NT80LAFA","1NT80LAXXA","1NT80LAXXE","1NT80LAXXF","1NT80VT","1NT80BAW0","1NT80BDF","1NT80BDF","1NT80BDF"
Appendectomy	1NV89DA,"1NV89LA"
Cholecystectomy	1OD89,"1OD89","1OD57DA","1OD57LA"
Colectomy	"1NM87DA","1NM87DF","1NM87DE","1NM87DN","1NM87LA","1NM87RN","1NM87RD","1NM87RE","1NM87DX","1NM87DY","1NM87GB","1NM87TF","1NM87TG","1NM87WJ","1NM89DF","1NM89DX","1NM89GB","1NM89RN","1NM89TF","1NM89WJ","1NM91DF","1NM91DE","1NM91DN","1NM91RN","1NM91RD","1NM91RE","1NM91DX","1NM91TF","1NM91DY","1NM91TG"
Pelvic Pouch	1NQ84LAXXG,"1NQ84DAXXG"
Fistula management	"1NP86ME","1NP86MEXXA","1NP86MEXXF","1NP86MEXXE","1NP86MEXXG","1NP86MH","1NP86MHXXA","1NP86MHXXF","1NP86MHXXE","1NP86MHXXG","1NP86MQ","1NP86MQXXA","1NP86MQXXF","1NP86MQXXE","1NP86MQXXG","1NP86MR","1NP86RHXXA","1NP86MRXXF","1NP86MRXXE","1NP86MRXXG","1NP86MT","1NP86MTXXA","1NP86MTXXF","1NP86MTXXE","1NP86MTXXG","1NP86MEW3","1NP86MRW3","1NT86ME","1NT86MEFA","1NT86MEXXG","1NQ86ME","1NQ86MEXXL","1NQ86MEXXE","1NQ86MEXXF","1NQ86MEXXG","1NQ86MH","1NQ86MHXXL","1NQ86MHXXE","1NQ86MHXXF","1NQ86MHXXG","1NQ86MR","1NQ86MRXXL","1NQ86MRXXE","1NQ86MRXXF","1NQ86MRXXG","1NQ86MRXXH","1NQ86MRXXI","1NQ86MRXXJ"
Proctectomy	"1NQ87LA","1NQ87DA","1NQ87PF","1NQ87DE","1NQ87DA","1NQ87RD","1NQ87TF","1NQ87DX","1NQ87PB","1NQ89SF","1NQ89KZ","1NQ89GV","1NQ89AG","1NQ89SFXXG","1NQ89KZXXG","1NQ89GVXXG","1NQ89RS","1NQ89LH","1NQ89AB","1NQ89RSXXG","1NQ89LHXXG"
Stoma reversal/revision	"1NK82RR","1NM82RS","1NM82EP","1NK82EN","1NK82RR","1NK82DP","1NK82RF","1NK82DN","1NK82RE","1NK82EM","1NK82RQ","1OW87DA","1OW87LA","1NM77RS","1NM77EP","1NM77TG","1NM77DY","1NM77DZ","1NM77DZ","1NM77DZ"
Thyroidectomy	"1FU87NZ","1FU87PZ","1FU87QT","1FU87DA","1FU87NZAG","1FU87PZAG","1FU87QTAG","1FU87DAAG","1FU89NZ","1FU89PZ","1FU89DA","1FU89NZAG","1FU89PZAG","1FU89DAAG"

Parathyroidectomy	1FV87NZ,"1FV87PZ","1FV87NZAG","1FV87PZAG","1FV89NZ","1FV89PZ"
Adrenalectomy	1PB87DA,"1PB87LB","1PB87PF","1PB87QF","1PB89"
Gastrectomy	"1NF87DG","1NF87RP","1NF87DH","1NF87RG","1NF87DA","1NF87LA","1NF87DQ","1NF87RJ","1NF87GX","1NF87SH","1NF87DJ","1NF87RH","1NF87DL","1NF87RK","1NF87EL","1NF89DAXXF","1NF89LAXXF","1NF89TH","1NF91LAXXF","1NF91RG","1NF91RJXXF","1NF91RP","1NF91SG"
Bariatric	"1NF78XP","1NF78XO","1NF78EJ","1NF78WJ","1NF78GB","1NF78SH","1NF78DQ","1NF78SJ","1NF78DO","1NF78SI","1NF78DI","1NF78VT","1NF78BN","1NF78DW","1NF78EI","1NF78BN","1NF76GW","1NF76DZ","1NF76EA","1NF76EB","1NF76DQ","1NF76SG","1NF76TH","1NF76TJ","1NF76TQ"
Gastric pexy /	1NF73DA,"1NF73LA","1NF74DA","1NF74LA"
Peptic Ulcer Management	1NK76DR,"1NK76SK","1NK76DS","1NK76SL","1NK76DR","1NK76DS","1NK76SK"
Hemorrhoidectomy	"1NQ87CAFA","1NQ87BAFA","1NQ87CA","1NQ87BA","1NT87URFA","1NT87LA","1NT87UR","1NT59CAAD","1NT59CAAG","1NT59CADU","1NT59CAGX","1NT59CAX7"
Hernia Repair	"1SY80DA","1SY80LA","1SY80LAXXN","1SY80DAXXN","1SY80GDXXN","1SY80WJ","1SY80DAXXA","1SY80LAXXA","1SY80LAXXQ","1SY80LAXXL","1SY80DAXXL","1SY80LAXXF","1SY80DAXXF","1SY80LAXXQ","1SY80LAXXG","1SY80DAXXG","1SY80LATZ","1SY80LAXXK"
Hepatectomy/Liver Cyst Removal	1OA87LA,"1OA87DA","1OA87LA","1OA87LAAZ"
BD repair/resect	"1NT80DA","1OE89SR","1OE89UF","1OE76DV","1OE76SR","1OE76EE","1OE76UF","1OE76EG","1OE76VK","1OE87LA","1OE87DA","1OW89LA","1OW89DA","1OE80DA","1OE80LA","1OE80DAXXA","1OE80LAXXA","1OE80DAXXQ","1OE80LAXXQ"
Pancreatectomy	1OJ87LA,"1OJ87DA","1OJ87VC","1OJ87VK","1OJ89LA","1OJ89VZ","1OK89LA","1OK89XN","1OK91"
Whipple	1OK87LA,"1OK87VZ","1OK87XN","1OK87WA","1OK91XN"
Mastectomy	1YM87,"1YM88","1YM90","1YM89","1YM91","1YM92"
Lymphadenectomy	"1MC87","1MC89","1MC91","1MD87","1MD89","1MD91","1MG87","1MG89","1MH87","1MH89","1MJ87","1MJ89","1MJ91"
Sarcoma Resection	1OT91
Lactal Duct Excision	1YL87,"1YL89"
Abdominal /chest wall resection	1SZ87DA,"1SZ87LA","1SZ87LAXXA","1SZ87LAXXE","1SZ87LAXXF","1SZ87LAXXG","1SZ87LAXXN","1SZ87LAXXQ"
Peritoneal dialysis catheter	1OT53DALF,"1OT53DATS","1OT53HATS","1OT53LALF","1OT53LATP","1OT53LATS"
Small Bowel resection/repair	"1NK87DA","1NK87LA","1NK87DN","1NK87RE","1NK87DP","1NK87RF","1OW80LA","1OW80DA","1NK76DN","1NK76RE","1NK76DP","1NK76RF","1NK76DQ","1NK76RJ","1NK80DA","1NK80LA","1NK80DAXXE","1NK80DAXXF","1NK80LAXXN","1NK80LAXXQ"

Lysis of Adhesions	"1OT72DA","1OT72LA","1OT72DAAG","1OT72LAAG","1NP72DA","1NP72LA","1NP72DAAG","1NP72LAAG","1OT87LA", "1OT87DA"
Splenectomy	"1OB89DA","1OB89LA","1OB87LA","1OB87LAX7","1OB87LAW2","1OB87LAW3","1OB87LAAG","1OB87LAXXE","1OB87LAXXN","1OB87PF","1OB87PFX7","1OB87PFW2","1OB87PFW3","1OB87PFAG","1OB87PFXXE","1OB87XXN","1OB87DA","1OB87DAX7","1OB87DAW3","1OB87DAAG","1OB87DAXXE","1OB87DAXXN","1OB89PF","1OB89LA"
Enterostomy	"1NK87DX","1NK87TF","1NK87DY","1NK87TG","1NK87GB","1NK87WJ","1NK77EN","1NK77EM","1NK77RQ","1NK77EN","1NK77RR","1NK77RRXXG"
Colostomy/reversal	1NM82DF,"1NM82DN","1NM82RN","1NM82RE"