ELECTRONIC SUPPLEMENTARY MATERIAL

Association between surgeon sex and days alive at home: A population-based cohort study

Kiyan Heybati BHSc[1]; Raj Satkunasivam, MD, MS[2-4]; Khatereh Aminoltejari, MD, MSc, FRCSC[5]; Hannah S Thomas, MBChB, MS[5]; Arghavan Salles, MD, PhD[6]; Natalie Coburn, MD, MPH[7]; Frances C. Wright, MD, MEd FRCSC[7]; Lesley Gotlib Conn, PhD[7]; Amy N. Luckenbaugh, MD[8]; Sanjana Ranganathan[9]; Carlos Riveros, MD[9]; Colin McCartney, MBChB, PhD, FRCA, FFARCSI, FRCPC[10]; Kathleen Armstrong, MD, MSc, FRCSC[2]; Barbara Bass, MD[11]; Allan S. Detsky, MD, PhD, CM[12-14]; Angela Jerath MD MSc[10*]; Christopher JD Wallis MD PhD[5,15*]

[1]Mayo Clinic Alix School of Medicine, Mayo Clinic, Rochester, MN, USA
[2]Division of Plastic Surgery, Department of Surgery, University of Toronto, Toronto, ON, Canada
[3]Center for Outcomes Research, Houston Methodist Hospital, Houston, TX, USA
[4]Department of Health Policy and Management, School of Public Health, Texas A&M University, College Station Texas, USA
[5]Division of Urology, Department of Surgery, University of Toronto, Toronto, ON, Canada
[6]Department of Medicine, Stanford University School of Medicine, Palo Alto, CA, USA
[7]Department of Surgery, Sunnybrook Health Sciences Center, Toronto, ON, Canada
[8]Department of Urology, Vanderbilt University Medical Center, Nashville, TN, USA
[9]Department of Urology, Houston Methodist Hospital, Houston, TX, USA
[10]Department of Anesthesia, Sunnybrook Health Sciences Center, Toronto, ON, Canada
[11]George Washington University, School of Medicine and Health Sciences, USA
[12]Department of Medicine, Mount Sinai Hospital and University Health Network, Toronto, ON, Canada
[13]Institute for Health Policy, Management and Evaluation, University of Toronto, Toronto, ON, Canada
[14]Department of Medicine, University of Toronto, Toronto, ON, Canada
[15]Division of Urology, Department of Surgery, Mount Sinai Hospital, Toronto, ON, Canada

**Co-senior authors with equal contribution*

Table of Contents:

Table 1. The RECORD Statement – Checklist of Items, Extended From the STROBE Statement

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Title and abstract					
	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found	Title page, Page 3	RECORD 1.1: The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included. RECORD 1.2: If applicable, the geographic region and timeframe within which the study took place should be reported in the title or abstract. RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.	Title page, Page 3
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported	Page 4		
Objectives	3	State specific objectives, including any prespecified hypotheses	Page 4		
Methods					
Study Design	4	Present key elements of study design early in the paper	Page 5		
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Page 5		

Participants	6	*(a) Cohort study* - Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study* - Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study* - Give the eligibility criteria, and the sources and methods of selection of participants *(b) Cohort study* - For matched studies, give matching criteria and number of exposed and unexposed *Case-control study* - For matched studies, give matching criteria and the number of controls per case	Pages 5-7	RECORD 6.1: The methods of study population selection (such as codes or algorithms used to identify subjects) should be listed in detail. If this is not possible, an explanation should be provided. RECORD 6.2: Any validation studies of the codes or algorithms used to select the population should be referenced. If validation was conducted for this study and not published elsewhere, detailed methods and results should be provided. RECORD 6.3: If the study involved linkage of databases, consider use of a flow diagram or other graphical display to demonstrate the data linkage process, including the number of individuals with linked data at each stage.	Page 5-7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.	Pages 6-7	RECORD 7.1: A complete list of codes and algorithms used to classify exposures, outcomes, confounders, and effect modifiers should be provided. If these cannot be reported, an explanation should be provided.	Pages 6-7
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Pages 5-7		
Bias	9	Describe any efforts to address potential sources of bias	Pages 6-7		

Study size	10	Explain how the study size was arrived at	Pages 5-6		
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	Pages 6-7		
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) *Cohort study* - If applicable, explain how loss to follow-up was addressed *Case-control study* - If applicable, explain how matching of cases and controls was addressed *Cross-sectional study* - If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses	Pages 6-7		
Data access and cleaning methods		..		RECORD 12.1: Authors should describe the extent to which the investigators had access to the database population used to create the study population. RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	Pages 5-7
Linkage		..		RECORD 12.3: State whether the study included person-level, institutional-level, or other data linkage across two	Pages 5-7

				or more databases. The methods of linkage and methods of linkage quality evaluation should be provided.	
Results					
Participants	13	(a) Report the numbers of individuals at each stage of the study (*e.g.*, numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed) (b) Give reasons for non-participation at each stage. (c) Consider use of a flow diagram	Pages 5-6, 8	RECORD 13.1: Describe in detail the selection of the persons included in the study (*i.e.*, study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram.	Pages 5-6, 8
Descriptive data	14	(a) Give characteristics of study participants (*e.g.*, demographic, clinical, social) and information on exposures and potential confounders (b) Indicate the number of participants with missing data for each variable of interest (c) *Cohort study* - summarise follow-up time (*e.g.*, average and total amount)	Page 8		Page 8
Outcome data	15	*Cohort study* - Report numbers of outcome events or summary measures over time *Case-control study* - Report numbers in each exposure category, or summary measures of exposure *Cross-sectional study* - Report numbers of outcome events or summary measures	Pages 8-10		Pages 8-10

Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Pages 8-10		Pages 8-10
Other analyses	17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	Pages 8-10		Pages 8-10
Discussion					
Key results	18	Summarise key results with reference to study objectives	Page 10		
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Page 12	RECORD 19.1: Discuss the implications of using data that were not created or collected to answer the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over time, as they pertain to the study being reported.	Page 12
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Pages 11-13		
Generalisability	21	Discuss the generalisability	Pages 10-13		

		(external validity) of the study results			
Other Information					
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Title page		
Accessibility of protocol, raw data, and programming code		..		RECORD 22.1: Authors should provide information on how to access any supplemental information such as the study protocol, raw data, or programming code.	Title page

Figure 1. Study Flow Diagram

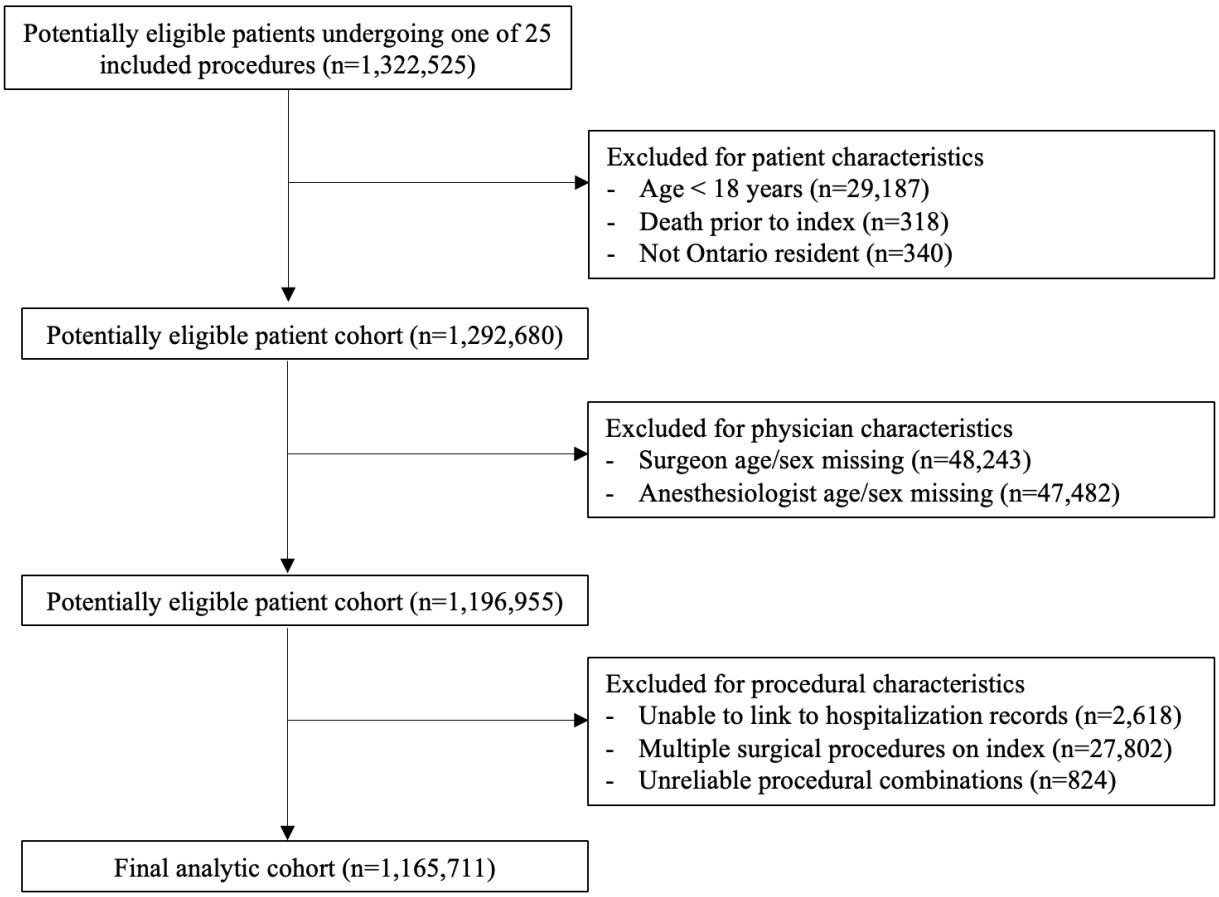

Table 2. Baseline Characteristics of Patients, by Surgeon Sex

Group	Variable	Label or value	Male Surgeon (1,014,657)	Female Surgeon (151,054)	Total (1,165,711)	P-value	Standardized Difference
Surgeon	Age	Mean (SD), years	49.8 (9.5)	45.1 (8.3)	49.2 (9.5)	<0.001	0.519
		Median (IQR), years	49 (42-57)	44 (38-51)	48 (41-56)	<0.001	0.503
	Annual case volume (quartiles), n (%)	1 - Lowest	225,407 (22.2%)	56,528 (37.4%)	281,935 (24.2%)	<0.001	0.337
		2-	257,544 (25.4%)	44,758 (29.6%)	302,302 (25.9%)		0.095
		3-	254,327 (25.1%)	30,976 (20.5%)	285,303 (24.5%)		0.109
		4 - Highest	277,379 (27.3%)	18,792 (12.4%)	296,171 (25.4%)		0.380
	Years in practice	Mean (SD), years	16.2 (8.6)	12.6 (8.1)	15.7 (8.6)	<0.001	0.431
		Median (IQR), years	17 (9-23)	11 (6-19)	17 (8-23)	<0.001	0.427
	Specialty, n (%)	Cardiothoracic Surgery	3,775 (0.4%)	203 (0.1%)	3,978 (0.3%)	<0.001	0.047
		General Surgery	324,155 (31.9%)	61,666 (40.8%)	385,821 (33.1%)		0.185
		Neurosurgery	56,049 (5.5%)	2,863 (1.9%)	58,912 (5.1%)		0.193
		Obstetrics and Gynecology	86,673 (8.5%)	54,696 (36.2%)	141,369 (12.1%)		0.704
		Orthopedic Surgery	379,088 (37.4%)	12,862 (8.5%)	391,950 (33.6%)		0.730
		Otolaryngology	16,410 (1.6%)	2,708 (1.8%)	19,118 (1.6%)		0.014
		Plastic Surgery	41,543 (4.1%)	13,485 (8.9%)	55,028 (4.7%)		0.197
		Thoracic Surgery	13,559 (1.3%)	1,476 (1.0%)	15,035 (1.3%)		0.034
		Urology	89,339 (8.8%)	1,080 (0.7%)	90,419 (7.8%)		0.387
		Vascular Surgery	4,066 (0.4%)	15 (0.0%)	4,081 (0.4%)		0.086
Anesthesiologist	Age	Mean (SD), years	48.9 (10.1)	49.2 (10.4)	48.9 (10.1)	<0.001	0.032
		Median (IQR), years	48 (41-57)	48 (41-57)	48 (41-57)	<0.001	0.022
	Sex, n (%)	Female	267,330 (26.3%)	44,492 (29.5%)	311,822 (26.7%)	<0.001	0.069
		Male	747,327 (73.7%)	106,562 (70.5%)	853,889 (73.3%)		0.069

	Annual case volume (quartiles), n (%)	1 - Lowest	234,001 (23.1%)	37,563 (24.9%)	271,564 (23.3%)	<0.001	0.042
		2 -	262,277 (25.8%)	43,735 (29.0%)	306,012 (26.3%)		0.070
		3 -	257,338 (25.4%)	38,867 (25.7%)	296,205 (25.4%)		0.008
		4 - Highest	261,041 (25.7%)	30,889 (20.4%)	291,930 (25.0%)		0.125
	Years in practice	Mean (SD), years	14.6 (9.3)	14.9 (9.6)	14.6 (9.4)	<0.001	0.038
		Median (IQR), years	14 (6-22)	14 (6-23)	14 (6-22)	<0.001	0.034
Patient	Age	Mean (SD), years	60.0 (17.2)	52.5 (16.3)	59.0 (17.3)	<0.001	0.446
		Median (IQR), years	62 (48-73)	51 (41-64)	60 (47-72)	<0.001	0.469
	Sex, n (%)	Female	600,293 (59.2%)	120,922 (80.1%)	721,215 (61.9%)	<0.001	0.466
		Male	414,364 (40.8%)	30,132 (19.9%)	444,496 (38.1%)		0.466
	Comorbidity, n (%)	ADG 0-5	263,940 (26.0%)	40,900 (27.1%)	304,840 (26.2%)	<0.001	0.024
		ADG 6-7	240,746 (23.7%)	37,511 (24.8%)	278,257 (23.9%)		0.026
		ADG 8-10	304,439 (30.0%)	45,875 (30.4%)	350,314 (30.1%)		0.008
		AGD>=11	205,532 (20.3%)	26,768 (17.7%)	232,300 (19.9%)		0.065
	Income quintile, n (%)	1 - Lowest	194,036 (19.1%)	28,275 (18.7%)	222,311 (19.1%)	<0.001	0.010
		2 -	205,328 (20.2%)	30,195 (20.0%)	235,523 (20.2%)		0.006
		3 -	204,020 (20.1%)	30,152 (20.0%)	234,172 (20.1%)		0.004
		4 -	206,707 (20.4%)	31,030 (20.5%)	237,737 (20.4%)		0.004
		5 - Highest	204,566 (20.2%)	31,402 (20.8%)	235,968 (20.2%)		0.016
Other	Hospital status, n (%)	Community hospital	678,409 (66.9%)	94,463 (62.5%)	772,872 (66.3%)	<0.001	0.091
		Academic hospital	336,248 (33.1%)	56,591 (37.5%)	392,839 (33.7%)		0.091
	Rurality, n (%)	Urban	893,124 (88.0%)	137,951 (91.3%)	1,031,075 (88.5%)	<0.001	0.109
		Rural	121,533 (12.0%)	13,103 (8.7%)	134,636 (11.5%)	<0.001	0.109
	Surgical procedure type, n (%)	Elective	806,928 (79.5%)	124,391 (82.3%)	931,319 (79.9%)	<0.001	0.072
		Urgent	207,729 (20.5%)	26,663 (17.7%)	234,392 (20.1%)		0.072

	Case complexity, n (%)	Low	348,450 (34.3%)	61,132 (40.5%)	409,582 (35.1%)	<0.001	0.127
		High	666,207 (65.7%)	89,922 (59.5%)	756,129 (64.9%)		0.127
	Duration of index surgery	Missing on duration, n (%)	57,853 (5.7%)	7,665 (5.1%)	65,518 (5.6%)	<0.001	0.028
		Mean (SD), minutes	121.1 (103.0)	135.8 (111.0)	123.1 (104.2)	<0.001	0.137
		Median (IQR), minutes	103 (74-144)	118 (82-169)	105 (75-148)	<0.001	0.237
	Year of index surgery, n (%)	2007	89,521 (8.8%)	10,337 (6.8%)	99,858 (8.6%)	<0.001	0.074
		2008	85,735 (8.4%)	11,238 (7.4%)	96,973 (8.3%)		0.037
		2009	85,322 (8.4%)	11,492 (7.6%)	96,814 (8.3%)		0.030
		2010	84,360 (8.3%)	11,471 (7.6%)	95,831 (8.2%)		0.027
		2011	85,119 (8.4%)	11,492 (7.6%)	96,611 (8.3%)		0.029
		2012	82,446 (8.1%)	11,723 (7.8%)	94,169 (8.1%)		0.013
		2013	84,742 (8.4%)	12,600 (8.3%)	97,342 (8.4%)		0.000
		2014	82,275 (8.1%)	13,307 (8.8%)	95,582 (8.2%)		0.025
		2015	78,693 (7.8%)	13,376 (8.9%)	92,069 (7.9%)		0.040
		2016	73,790 (7.3%)	12,109 (8.0%)	85,899 (7.4%)		0.028
		2017	66,313 (6.5%)	11,314 (7.5%)	77,627 (6.7%)		0.037
		2018	61,085 (6.0%)	10,633 (7.0%)	71,718 (6.2%)		0.041
		2019	55,256 (5.4%)	9,962 (6.6%)	65,218 (5.6%)		0.048

Table 3. Clustering based on Procedure Fee Code for the Number of Days Alive and at Home at 30-, 90- and 365-Days of Index Surgery with Adjustment for Duration of Index Surgery, by Surgeon Sex

Time Period	Male versus Female Surgeon aRR (95% CI)	P-value
At 30 days	0.98 (0.97-0.99)	<0.001
At 90 days	0.99 (0.98-0.99)	<0.001
At 465	0.99 (0.98-1.00)	<0.001

Abbreviations: aRR - Adjusted risk ratio; CI - Confidence interval

N=1,100,193; Using GEE modeling dealing with clustering based on procedure fee code (negative binomial regression with log link), adjusted for surgeon age, surgeon specialty, surgeon annual case volume, surgeon years of practice, anesthesiologist age, anesthesiologist sex, anesthesiologist annual case volume, anesthesiologist years of practice, patient age, patient sex, patient comorbidity, rurality, income quintile, LHIN, hospital status, and year of index surgery, as well as duration of index surgery