

Surgical need among the ageing population of Uganda

Tu M Tran¹, Anthony T Fuller^{1,2}, Elissa K Butler³, Christine Muhumuza⁴, Vincent F Ssenono⁵, Joao Ricardo Vissoci¹, Fredrick Makumbi⁴, Jeffrey G Chipman⁶, Moses Galukande⁷, Michael M Haglund^{1,2,8}, Samuel Luboga⁹

1. Duke University Division of Global Neurosurgery and Neuroscience.
2. Duke University School of Medicine.
3. University of Washington Department of Surgery 1959 NE Pacific Street Box 356410 Seattle, WA 98195 USA.
4. Makerere University School of Public Health.
5. Uganda Bureau of Statistics, Kampala, Uganda; Statistics House, Plot 9 Colville Street Box 7186 Kampala, Uganda.
6. University of Minnesota Department of Surgery, Minneapolis, MN, USA; 420 Delaware Street SE Mayo Mail Code 195 Minneapolis, MN 55455 USA.
7. Makerere University College of Health Sciences, Kampala, Uganda.
8. Duke University Department of Neurosurgery, Durham, NC, USA Durham, NC, USA 310 Trent Drive, Room 301 Durham, NC 27710 USA.
9. Makerere University College of Health Sciences, Department of Anatomy, Kampala, Uganda P. O. Box 7072, New Mulago Hospital Complex Kampala, Uganda.

Abstract

Background: Uganda's ageing population (age 50 years and older) will nearly double from 2015 to 2050. HIV/AIDS, diabetes, stroke among other disease processes have been studied in the elderly population. However, the burden of disease from surgically-treatable conditions is unknown.

Objectives: To determine the proportion of adults above 50 years with unmet surgical need and deaths attributable to probable surgically-treatable conditions.

Methods: A cluster randomized sample representing the national population of Uganda was enumerated. The previously validated Surgeons Overseas assessment of surgical need instrument, a head-to-toe verbal interview, was used to determine any surgically-treatable conditions in two randomly-selected living household members. Deaths were detailed by heads of households. Weighted metrics are calculated taking sampling design into consideration and Taylor series linearization was used for sampling error estimation.

Results: The study enumerated 425 individuals above age 50 years. The prevalence proportion of unmet surgical need was 27.8% (95%CI, 22.1-34.3). This extrapolates to 694,722 (95%CI, 552,279-857,157) individuals living with one or more surgically treatable conditions. The North sub-region was observed to have the highest prevalence proportion. Nearly two out of five household deaths (37.9%) were attributed to probable surgically treatable causes.

Conclusion: There is disproportionately high need for surgical care among the ageing population of Uganda with approximately 700,000 consultations needed.

Keywords: Surgical need, ageing population, Uganda.

DOI: <https://dx.doi.org/10.4314/ahs.v19i1.54>

Cite as: Tran TM, Fuller AT, Butler EK, Muhumuza C, Ssenono VF, Vissoci JR, et al. Surgical need among the ageing population of Uganda. *Afri Health Sci.* 2019;19(1). 1778-1788. [https:// dx.doi. org/ 10.4314/ abs. v19i1.54](https://dx.doi.org/10.4314/ahs.v19i1.54)

Corresponding author:

Samuel A Luboga,
Department of Anatomy, Makerere University
College of Health Sciences, School of Biomedical
Sciences. P. O. Box 7072
New Mulago Hospital Complex Kampala, Uganda
Email: lubogasam@gmail.com

Introduction

Uganda's ageing population (age 50 years and older) will almost double as percentage of the total population from 7.2% in 2015 to 12.5% by 2050¹. Naturally with increased life expectancies, non-communicable diseases (NCDs) not only become more prevalent, but also more problematic with delayed diagnosis, which is even worse in older adults, where utilization of health services by older adults

is considerably lower than their middle age counterparts². In Uganda, individuals remain economically productive well into advanced years, thus those living with moderate to severe disabilities experience some degree of community marginalization^{3,4}. Recognizing such vulnerabilities, the Ugandan Ministry of Gender, Labour, and Social Development (MGLSD) issued its 2009 comprehensive policy statement to promote quality of life for among aging persons, specifically adults 60 years and older,⁵. The policy calls for focused health studies on the elderly population; to date, studies have been predominantly focused on the burden of HIV/AIDS⁶⁻¹¹, diabetes and stroke and their risk factors^{4,12-15}, and health care seeking behavior^{16,17}.

No study in Uganda on the sub-population of adults over 50 years has focused on the burden of surgically treatable conditions. Older adults live with disproportionately higher rates of disability¹⁴ and musculoskeletal diseases², which have the highest frequency of operative intervention¹⁸. Surgical care for older adults differs than younger age groups: (1) co-morbidities are much more prevalent with increasing age¹⁹, (2) longer length of hospitalization is required for major operations as well as higher incidence of indications for critical care, and lengthier process of rehabilitation²⁰, and (3) older adults are more likely to require end-of-life care for terminal diseases²¹. Surgical capacity in low-income countries, such as Uganda, is far from adequate given the world's poorest third deliver 6% of annual surgical procedures²². Surgical capacity of large government hospitals in Uganda is well below the standards recommended by the WHO²³ and critical care infrastructure is in dire need²⁴.

We undertook a national cross-sectional household survey to quantify unmet surgical need. It is envisaged that quantifying unmet need among the ageing population would supply the evidence needed for clinicians, advocates, and policymakers to improve the accessibility and equity of essential surgical care, given the considerably differing needs of the older adults than the general population (age 18-49 years) in the process of surgical care delivery. This analysis describes the surgical burden among adults age 50 years and older. Given fairly recent developments of targeted priorities provided in the 2009 MGLSD policy, the provision of surgical care should be integrated into future health priorities for Uganda's ageing population.

Methods

Setting and sampling

Uganda is a country of 34.9 million inhabitants²⁵ where the health system is coordinated and organized by the national and District-level governments through a shared-governance system²⁶. Referral networks are organized at the District level starting with Health Centre I to the District Hospital; there are 13 Regional Referral Hospitals and 2 National Referral Hospitals²⁷. Continuing professional education in geriatrics is an enumerated priority outlined in MGLSD 2009 policy, yet it has not reached surgically-related fields in any systematic effort. Palliative care is scarcely available but made possible by NGOs, such as Hospice Africa Uganda, without significant government inputs.

A cluster sample was designed by the Uganda Bureau of Statistics (UBOS) to capture a representative national sample. One hundred and five enumeration areas (EAs), or clusters, were selected by UBOS using probability proportional to size (PPS) sampling from 80,000 EAs after stratifying by urban/rural and 10 Sub-Regions²⁸. Total sample size was specified for 1% precision using a 6.3% prevalence proportion of unmet surgical need acquired from a pilot study in the Wakiso District²⁹. Collaborating with the Performance Monitoring and Evaluation 2020 (PMA 2020) Uganda program, this study hired 105 experienced, field-proven Resident Enumerators (RE), who were highly socially embedded into the EA. Further details of sampling design can be found in a previous methods report of this study³⁰.

Survey instrument and data collection

The Surgeons Overseas Assessment of Surgical Need (SOSAS) instrument was deployed with slight modifications to add more response options but maintained comparability with previous deployments of SOSAS^{31,32}. In each EA, an RE sampled up to 24 households. At each household, the head of household provided household demographics, information on health facility access (using standard referral facility list for each EA), and details of household deaths within the previous 12 months. Subsequently, up to two household members were randomly selected to respond to a head-to-toe verbal interview to elicit any present or past surgically treatable conditions. Therefore, a person over age 50 years could be part of the

household roster and available for random selection, but she/he may not be selected after two members are randomly chosen. Anatomic regions included: (1) Face and Head, (2) Neck, (3) Chest, (4) Breast, (5) Back, (6) Abdomen, (7) Groin Male, (8) Groin Female, (9) Buttocks, and (10) Extremities. This was based on self-reporting of present or history of signs and symptoms indicative of wounds (injury or non injury – abscesses and ulcers), burns, growth/mass/swelling, deformities (acquired or congenital), and anatomical region-specific conditions, such as history of caesarean for the abdomen or diagnosed lung cancer for chest region. The sub-population identified as “ageing” included all household members age 50 years and older.

National data collection occurred between 20th August 2014 and 12th September 2014. Households were selected randomly from a sampling frame, which was created by fully listing and mapping of all households in the EA prior to enumeration. Eligibility criteria for household members were consistent with the DHS definitions²⁸. Household member selection was completely random and both sections of the SOSAS instrument were administered using smart phones operating Open DataKit software (University of Washington, Seattle, WA, USA).

Data analysis

Household level, individual level, and post-stratification weights were computed with support of UBOS and applied to compute weighted proportions, confidence intervals, and regression model outputs through Taylor-Series Linearization for variance estimation. Primary and secondary sampling units were EA and household, respectively. The hierarchical multivariate regression model accounted for potential clustering at the EA and household level; the main outcome variable for this study was existing unmet surgical need, which was defined as the individual self-reporting one or more existing surgically treatable conditions. A 2-cycle Delphi process allowed experienced surgeons and medical student trainees to rate likelihood that the self-reported conditions could have been cured or improved with a minor or major surgical

procedure; raters were blinded to one another’s ratings. Any condition or cause of death deemed not likely surgically-treatable were discarded from analysis. Age-specific mortality for deaths among adults over 50 years were computed with denominator as the sum of deceased and live household members available for selection. The prevalence of unmet surgical need map was created using QGIS (QGIS Development Team). All statistical analyses were performed in STATA 13 (StataCorp, College Station, TX, USA).

Ethical aspects

This study was approved by the Uganda Council of Science and Technology, Makerere University School of Medicine Research and Ethics Committee, Duke University Health System IRB, and University of Minnesota Medical School IRB. The head of household and each individual respondent provided verbal informed consent prior to initiating the survey. Given the low risk for study participation, verbal consent was deemed sufficient and avoided a way of linking survey responses to names of individuals had they provided written consent.³⁰ Individual respondents provided verbal consent and while contingencies were in place for legal surrogate consent, all adults in this study were able to provide consent independently.

Results

The cross-sectional survey reached 2,315 households (96.4% response rate) in which 868 individuals age 50 years and older were available for selection. We enumerated 425 respondents (ages 50-59 years: 181 individuals, 60-69 years: 120, >70 years: 124). Literacy was significantly lower among individuals age >70 years at 18.3% (34.2% for adults age 50 years and older). Farming was the most common occupation reported (Table 1). Notable health care facility access results include: 60 minute median time-to-facility for primary level facilities, 31.5% live in households that cannot afford transport costs to their Regional Referral Hospital (tertiary level), and proportion of individuals living in households that cannot afford transport is much higher for those age >70 years (Table 1).

Table 1: Demographic and household characteristics of individuals age 50 years and older (N = 425)

		Total (≥50 years)		50-59 years		60-69 years		≥ 70 years	
		n	Weighted% (95% CI)	n	Weighted% (95% CI)	n	Weighted% (95% CI)	n	Weighted% (95% CI)
Gender	Male	185	53.6, 48.5-58.6	86	55.5, 47.8-63.0	50	55.8, 47.0-64.3	49	48.3, 38.6-58.0
	Female	240	46.4, 41.4-51.5	95	44.5, 37.0-52.2	70	44.2, 35.7-53.0	75	51.7, 41.9-61.3
Literate	Yes	127	34.2, 28.5-40.4	72	43.1, 34.3-52.3	35	36.3, 26.4-47.6	20	18.3, 10.9-29.0
Occupation	Farmer	259	65.1, 57.2-72.2	119	70.2, 59.5-79.1	75	67.5, 56.7-76.7	65	54.6, 44.2-64.7
	Homemaker	61	10.7, 7.4-15.3	18	7.2, 4.1-12.5	19	10.7, 6.7-16.6	24	16.2, 8.9-27.6
	Retired, unemployed	50	11.7, 7.2-18.5	13	6.6, 2.9-14.4	13	11.1, 5.7-20.6	24	20.1, 12.4-31.0
	Self-employed	24	5.6, 3.4-8.9	16	8.4, 4.9-14.0	7	6.0, 2.4-14.2	1	0.7, 0.0-4.9
	Domestic helper	17	3.8, 2.1-7.0	5	2.4, 1.0-5.7	4	2.8, 0.9-8.5	8	7.1, 3.1-15.4
	Government employee	7	1.5, 0.7-3.2	4	2.0, 0.7-5.6	1	0.9, 0.1-6.5	2	1.2, 0.3-4.9
	NGO employee	7	1.6, 0.7-3.9	6	3.1, 1.1-8.2	1	1.1, 0.1-7.5	0 (0)	N/A
Education	None	300	66.8, 59.7-73.3	109	56.0, 46.3-65.2	89	70.2, 58.8-79.6	102	80.2, 70.2-87.5
	Primary School	84	23.4, 18.5-29.1	47	30.7, 23.1-39.4	19	18.8, 11.8-28.7	18	16.7, 10.1-26.3
	Secondary School or more	36	9.8, 6.8-13.8	21	13.4, 8.4-20.7	11	11.0, 5.9-19.4	4	3.1, 0.9-9.9
Primary Health Facility	Mechanized transport	159	39.1, 31.3-47.5	68	40.1, 30.1-51.1	49	43.2, 31.5-55.8	42	33.3, 24.3-43.8
	†Time-to-facility, med (IQR)	60 (30 - 120)		60 (30 - 120)		67.5 (40.5 - 120)		60 (33.5 - 120)	
	‡Travel cost, med (IQR)	750 (250 - 3500)		750 (250 - 3500)		1500 (250 - 3500)		750 (250 - 3500)	
	Unable to afford	64	17.0, 12.5-22.8	14	8.9, 5.1-14.9	18	15.4, 9.1-24.9	32	32.5, 22.1-44.9
Secondary Health Facility	Mechanized transport	324	79.6, 73.7-84.4	140	81.8, 73.4-87.9	86	75.6, 65.6-83.3	98	80.1, 71.2-86.8
	†Time-to-facility, med (IQR)	105 (56 - 180)		90 (50 - 180)		110 (60 - 200)		120 (60 - 185)	
	‡Travel cost, med (IQR)	3500 (1500 - 7500)		3500 (1500 - 7500)		3500 (1500 - 7500)		3500 (3500 - 15,000)	
	Unable to afford	105	26.3, 19.7-34.1	30	18.3, 11.7-27.3	29	24.5, 16.0-35.7	46	40.4, 28.8-53.2
Tertiary Health Facility	Mechanized transport	393	93.2, 88.2-96.2	174	97.0, 93.1-98.7	109	90.9, 80.3-96.0	110	89.8, 80.8-94.8
	†Time-to-facility, med (IQR)	180 (95 - 308)		180 (105 - 300)		250 (85 - 350)		180 (92.5 - 300)	
	‡Travel cost, med (IQR)	15,000 (7500 - 35,000)		15,000 (7500 - 35,000)		15,000 (7500 - 35,000)		15,000 (7500 - 35,000)	
	Unable to afford	125	31.5, 24.6-39.3	40	22.8, 15.5-32.3	36	33.5, 23.1-45.9	49	43.4, 31.8-55.7

†Time in minutes

‡Currency in Ugandan Shillings (UGX)

Prevalence of unmet surgical need

Prevalence of unmet surgical need among the ageing population was 27.8% (95%CI, 22.1-34.3) contrasting with 9.0% (95%CI, 7.5-10.7) for those below 50 years of age. Using an estimate of 2,499,000 million base population above age 50 years^{1,25}, there are 694,722 (95%CI, 552,279-857,157) living with unmet surgical need. Geographically, the North Sub-Region has the highest proportion of unmet surgical need (Figure 1). Results of the logistic regres-

sion model suggest there was no evidence that decade of life, gender, urban/rural locale were strongly associated with presence of unmet surgical need (Table 2). Variables dropped from the model included education level (none, primary, secondary or higher), literacy, occupation, travel time and travel costs for primary, secondary, and tertiary level health facilities. Self-reported health status was the only variable strongly associated with presence of unmet surgical need (adjusted OR 2.84, 95%CI 1.65, 4.87).

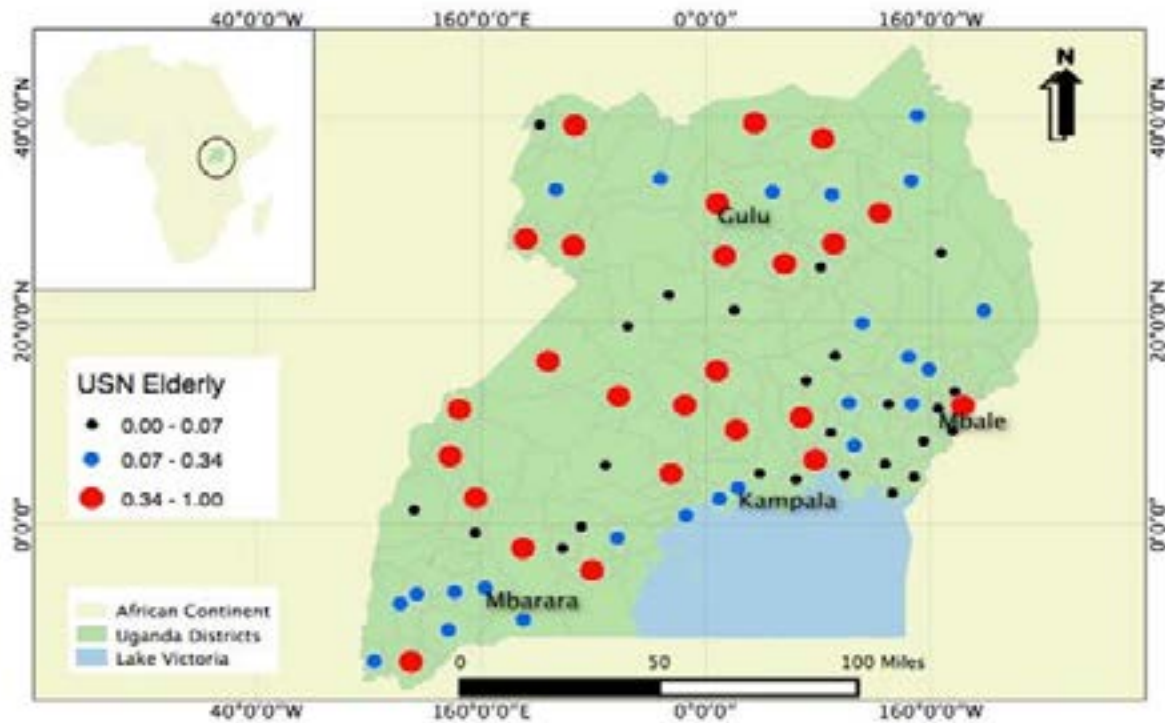


Figure 1: Prevalence of unmet surgical need among individuals age 50 years and older by clusters

Table 2: Hierarchical multivariate logistic regression model for having unmet surgical need

		Did not have one or more existing surgically treatable condition	Unmet surgical need (had 1 or more existing surgically treatable condition)	Adjusted Odds Ratio, 95% CI	<i>p</i> value
Age group	50-59 years, n (Weighted%)	145 (78.1)	36 (21.9)	Referent	
	60-69 years, n (Weighted%)	91 (73.3)	29 (26.7)	1.14, 0.66-1.99	0.635
	≥70 years, n (Weighted%)	76 (62.0)	48 (38.0)	1.67, 0.93-3.00	0.086
Gender	Male, n (Weighted%)	132 (69.9)	53 (30.1)	Referent	
	Female, n (Weighted%)	180 (74.9)	60 (25.1)	0.63, 0.37-1.09	0.099
Location	Urban, n (Weighted%)	57 (81.2)	14 (18.8)	Referent	
	Rural, n (Weighted%)	255 (70.4)	99 (29.6)	1.75, 0.78-3.91	0.172
Health Status	Generally healthy, n (Weighted%)	192 (82.3)	39 (17.7)	Referent	
	Not generally healthy, n (Weighted%)	120 (60.3)	74 (39.7)	2.84, 1.65-4.87	<0.001

Surgically treatable conditions

There were 136 prevalent surgically treatable conditions among 113 individuals. Surgical care was sought in 95 of 136 (65.1%) conditions; financial hardship was the most commonly cited reason for not receiving care. These individuals could not afford direct cost of care, the transportation costs, or lacked social support from their fam-

ily structure (Table 3). There were 11 conditions treated inadequately by traditional healers yielding a total of 106 conditions that led individuals to seek care. Unavailability of services was cited in only 15 instances (11%) as a barrier to surgical care. Significant physical disability was reported by 24.0% (95%CI, 18.5-30.4) including: needing help with transport, help with daily living, or inability to work.

Table 3: Existing surgically treatable conditions among respondents age 50 years and older (N = 136)

	Total (≥50 years)	50-59 years	60-69 years	≥ 70 years
Existing surgically treatable condition	136	43	37	56
Sought healthcare				
Yes, n (Unweighted%)	95 (69.8)	28 (65.1)	30 (81.1)	37 (66.1)
No, n (Unweighted%)	41 (30.2)	15 (34.9)	7 (18.9)	19 (33.9)
Sought traditional healer, n (Unweighted%)	25 (18.4)			
Before formal healthcare	14 (10.3)			
If no care, why?	n (Unweighted%)	n	n	n
Direct cost of care not affordable	53 (39.0)	17	14	22
Transportation costs unaffordable	23 (16.9)	5	9	9
No available facility, material resources, or personnel	15 (11.0)	6	3	6
Lacking social support	14 (10.3)	4	5	5
No perceived need	14 (10.3)	4	4	6
Fear or lack of trust	12 (8.8)	3	2	7
No time	3 (2.2)	1	0	2
Type of surgically treatable condition	n (Unweighted%)	n (Unweighted%)	n (Unweighted%)	n (Unweighted%)
Acquired deformity	34 (25.0)	12 (27.9)	10 (27.0)	12 (21.4)
Growth, mass, swelling	29 (21.3)	6 (14.0)	9 (24.3)	14 (25.0)
Wounds (from injury)	21 (15.4)	4 (9.3)	7 (18.9)	10 (17.8)
Chronic back pain	9 (6.6)	0 (0.0)	4 (10.8)	5 (8.9)
Keloid	8 (5.9)	2 (4.6)	2 (5.4)	4 (7.1)
Wounds (not from injury)	8 (5.9)	6 (14.0)	0 (0.0)	2 (3.6)
Abdominal Hernia	6 (4.4)	1 (2.3)	3 (8.1)	2 (3.6)
Abdominal Pain	6 (4.4)	3 (7.0)	0 (0.0)	3 (5.4)
Burn	5 (3.7)	4 (9.3)	1 (2.7)	0 (0.0)
*Other	5 (3.7)	1 (2.3)	1 (2.7)	3 (5.4)
Deformity Congenital	2(1.5)	2 (4.6)	0 (0.0)	0 (0.0)
Pelvic Organ Prolapse	2 (1.5)	1 (2.3)	0 (0.0)	1 (1.8)
Groin Hernia	1 (0.7)	1(2.3)	0 (0.0)	0 (0.0)
Reported disability, from previous or existing surgically treatable condition, n (Weighted%)	101 24.0, 18.5-30.4	29 16.4, 10.4-24.9	28 22.9, 14.6-34.1	44 36.8, 27.4-47.3

*Other surgically treatable conditions include: Obstetric fistula (2), History of untreated obstructed labor/symptoms of vesicovaginal fistula (1), Difficulty urinating (1), Severe hearing problems (1)

Acquired deformities, masses, and wounds were most of prevalent conditions (Table 3). Individuals age 60-69 years and >70 years reported higher frequencies of masses, wounds from injuries, and chronic back pain than those age 50-59 years. Untreated hernias (7 cases), burns (5), pelvic organ prolapse (2), obstetric fistula (2), and congenital deformities (2) were least prevalent. Unlike

their younger counterparts (age 18-49 years), older adults were more likely to have untreated conditions in the face, head, neck (35.0%) region rather than the extremities (11.0%), though proportion of face, head, neck conditions decreased substantially in those age 60-69 years and >70 years. Surgically treatable conditions in the buttocks region, which also included potential gastrointestinal conditions, were least prevalent (Figure 2).

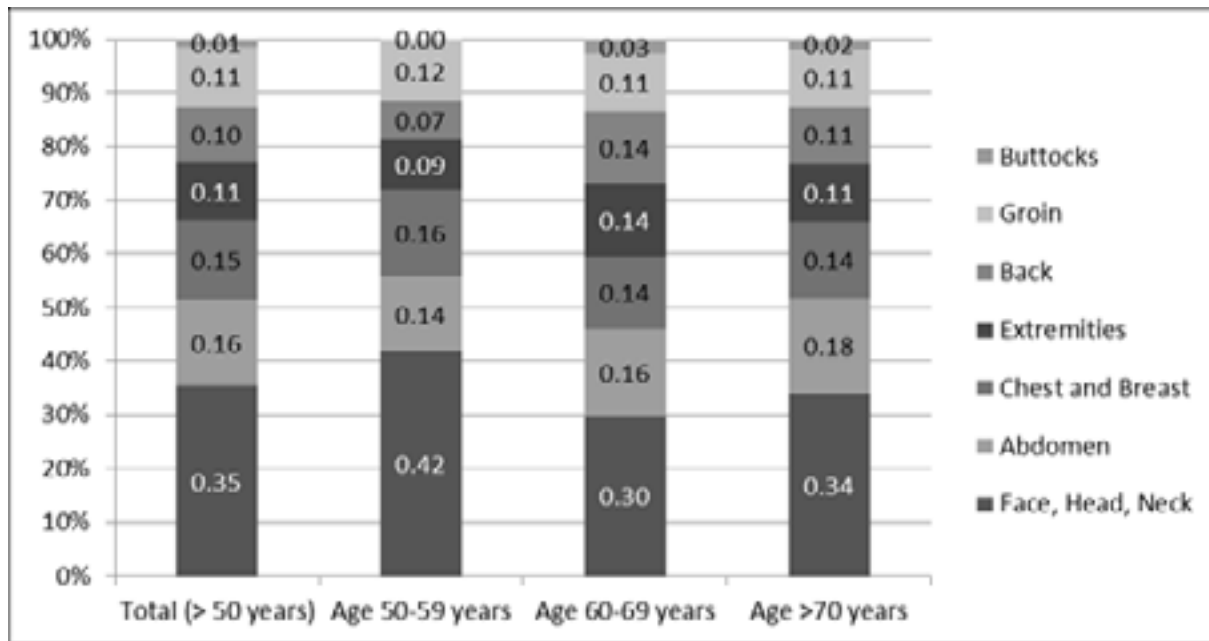


Figure 2: Existing surgically treatable conditions by Anatomical regions among individuals age 50 years and older

Surgical deaths

A total of 29 deaths among adults age 50 years and older occurred within the 12 months prior to enumeration; 11 of these deaths (37.9%) involved symptoms that could have been treated by surgical care, including 3 deaths where an operative procedure was noted (Table 4). The most common associated sign/symptoms/causes was presence of an acquired deformity (3 of 4 were cancers).

Care was sought for 10 of 11 surgical deaths; financial constraints (direct cost of care, transport, lacking social support) were cited for 3 surgical deaths. There were 3 surgical deaths without reported reasons for the deceased not receiving care. Age-specific mortality rate from probable surgically treatable causes was highest for those dying within 8th decade: 24.3 per 1,000 (>70 years), 8.1 per 1,000 (60-69 years), and 7.4 per 1,000 (50-59 years).

Table 4: Deaths among individuals ages 50 years and older (N = 29)

Total deaths in ≥ 50 years, N	29	
Not surgically treatable, n (Unweighted%)	18 (62.1)	
Surgically treatable deaths, n (Unweighted%)	11 (37.9)	
Acquired deformity	4 (36.4)	
Growth, mass, swelling	2 (18.2)	
Abdominal pain	2 (18.2)	
Wound (injury)	1 (9.1)	
Wound (not due to injury)	1 (9.1)	
Burn	1 (9.1)	
Surgical deaths at home	8 (72.7)	
Age-specific surgical mortality rate (per 1000)		
Total (≥ 50 years)	12.3	
50-59 years	7.4	
60-69 years	8.1	
≥ 70 years	24.3	
		If no care, why?
		Direct cost of care not affordable
		1
		Transportation costs unaffordable
		1
		Lacking social support
		1
		Fear or lack of trust
		1
		No time
		1
		No stated reason
		3
		Surgical procedure not curative
		3

Discussion

There are potentially 694,722 adults age 50 years and older with unmet surgical need, and nearly 2 of 5 deaths in this age group may have benefitted from surgical care. Since the ageing population will grow fastest in developing countries^{5,33}, surgical burden will increase in absolute and relative terms while the Ugandan healthcare system is unprepared to meet such demands. Surgical care in older adults is necessarily more resource intensive due to tendency for late presentations, complications from frailty, and presence of comorbidities^{17,34}. Reducing the instances of late presentation could be a cost-effective area of intervention. This requires an integrated approach to the ageing population in which surgical fields are included, and the MOH's recent commitments to controlling NCDs provides a potential care delivery platform³⁵. Existing limitations in surgical capacity should not be a deterrent to investments^{23,36,37}; getting closer to the gold standard of providing surgical care can be achieved with relatively low-cost organizational interventions: collaboration of multidisciplinary clinical teams at referral hospitals, increased access to rehabilitation care at lower level facilities, and inclusion of geriatrics into formative and continuing professional education of the surgical workforce²¹.

In our study, older adults did not seek surgical care for 30.2% of prevalent conditions, while the same measure for counterparts in younger age groups (age 18-49) is considerably lower. Lack of confidence in health services has been proposed as a major contributor to lower healthcare utilization among older adults³⁸. However, there are also family and social demands on older adults such as taking on roles as a community-leader publicly and privately serving as foster parents^{2,8}. These demand-side barriers should not be seen as deterrents but further cause to make essential surgical care more accessible to the ageing population. While 24% report some level of disability from prevalent surgically treatable conditions, surgical care in many cases may lead to reduced level of disability, improved quality of life, which yield economic returns to society as we observed that 90% of the adults age 50 years and older remain productive well into 7th and 8th decades of life.

Financial constraints include the direct cost of care, transport to a surgically-capable healthcare facility (up to 43% of adults age >70 years cannot afford transport costs), and opportunity costs. In addition to lacking social support³⁹, the perception or ignorance of a surgical condition's manifestation contribute to nearly 1/3 of adults 50 years and above living with unmet surgical need. The 2009 policy from the Ministry of Gender, Labour, and Social Development (MGLSD) signals political commitment to addressing health and socioeconomic issues disproportionately faced by the elderly. Addressing financial barriers through improvement of socioeconomic status^{4,6} is certainly the underpinning for increasing utilization of health services in general, and previous health studies on older Ugandan adults have called for expansion of economic empowerment programs, such as Social Assistance Grants for Empowerment (SAGE)^{14,16}. For individuals with greater financial means, systems for risk pooling must be created and is recommended by the Lancet Commission on Global Surgery²².

This is the third analysis of surgical burden in an ageing population from a low-income country^{31,32}, and the only study of such focus in Uganda. Using the same survey instrument, Sierra Leone's prevalence of unmet surgical need among adults age 50 years and older is much higher at 60.7%, but proportion of household deaths of 36.1% is consistent with this study's main findings. Nepal's prevalence proportion of 54.0% is significantly higher than this study's findings. Compared to Uganda, Sierra Leone's overall health system is not as well developed, especially in surgical fields represented by specialist-level surgical providers³¹. While Nepal has higher physicians per capita, the mountainous terrain throughout the country poses considerably greater geographical barriers to accessing care³². All three studies converge on the main finding that the ageing population disproportionately lives with unmet surgical need compared to younger counterparts age 18-49 years. It is expected that ageing is often accompanied by higher morbidity from chronic conditions, but more effective surgical care systems would not render the older adults with three times the prevalence proportion in Sierra Leone and Uganda, and nearly five times in Nepal.

The study's main limitation is reliance on self-reporting, and this can lead to an unknown set of underestimation and overestimation. The prevalence and incidence of malignancies increase with age; surgery is often one of the first line treatments for many non-hematologic tumors. Clinical diagnosis was not financially feasible during the time of this study's implementation. Surgically treatable problems of the groin and genitalia region are likely to be underreported⁴⁰, explaining marginal prevalence of pelvic organ prolapse, fistula, groin hernias, hematuria, and urinary retention. The buttocks region include gastrointestinal diseases requiring laboratory or endoscopic workup to diagnose; they were reported low in adults 50 years and older which is likely an underestimation. Still, if nearly 700,000 ageing adults in Uganda require at least a surgical consultation, there are considerable efforts to be implemented by stakeholders to meet this challenge. On the other hand, it is possible that unmet surgical need and verbal autopsy-derived details surrounding deaths may overestimate burden. Other studies in Uganda show oldest of the old tend to report ill-health¹⁷. Telescoping of household deaths could overestimate the mortality component, but the crude annual death rate was calculated at 13.5 per 1000 (official statistics is 10 per 1000)¹, thus we do not believe there is significant temporal telescoping of household deaths.

As the first attempt to quantify at a national level the burden of surgically treatable conditions in an ageing population, this study best functions as a baseline to describe the scope of the challenge: 700,000 surgical consultations are needed. Future research efforts require greater in-depth focus on this age group, diagnostic specificity requiring linkage with clinical service provision, and a longitudinal component to monitor burden over time¹³. The NCD and global surgery research agenda are gaining political priority in Uganda and is a promising avenue for incorporating research in surgical epidemiology and access to surgical care. An ideal research structure could be a demographic and health surveillance site, in which Uganda already has two that are actively used for NCD population studies^{41,42}.

Acknowledgement

This work would not be possible without the Uganda Bureau of Statistics collaboration and assistance in sampling design, guidance on implementing health surveys, and consultation in the analysis phase. We thank the Ugan-

da Ministry of Health Office of the Director of Planning and Makerere College of Health Sciences Office of the Principal for institutional support. We thank the enumerators and field supervisors for their dedication to data quality and the field supervisors for their leadership of implementation: Samuel Kagongwe, Mark Kashajja, Sheila Kisakye, Mable Luzze, Hassard Sempeera. SO-SAS Uganda was the first population survey to benefit from the generous collaboration of the Gates Institute for Population and Reproductive Health at Johns Hopkins Bloomberg School of Public Health, whose visionary leaders Professors Scott Radloff and Amy Tsui have made such collaborations possible. We are grateful to the Surgeons OverSeas organization, Dr. Reinou Groen, Dr. Shailvi Gupta, Dr. Adam Kushner, for guidance from initial design to numerous manuscripts. We dedicate this report in memory of Mr. Allan Ssekindi and Ms. Irene Tusiime, whose lives were tragically cut short.

Sources of support

Funding for this national survey was provided by the Duke Global Health Institute, Duke University Department of Neurosurgery, University of Minnesota Department of Surgery, Makerere University College of Health Sciences, and Johnson and Johnson Family of Companies. Funding sources played no role in study design, data collection, data analysis, or writing of the manuscript. All authors had full access to the data and executed their decision to submit this manuscript to your journal for publication.

Conflict of interest

None.

References

1. United Nations, Department of Economic and Social Affairs, Population Division (2015). World Population Prospects: The 2015 Revision, Key Findings and Advance Tables. Working Paper No. ESA/P/WP.241. Accessed February 2016.
2. Aboderin IA, Beard JR. Older people's health in sub-Saharan Africa. *Lancet*. 2015;385(9968):e9-e11.
3. Mulumba M, Nantaba J, Brolan CE, Ruano AL, Brooker K, Hammonds R. Perceptions and experiences of access to public healthcare by people with disabilities and older people in Uganda. *International Journal for Equity in Health*. 2014;13:76.
4. Kikafunda JK, Lukwago FB. Nutritional status and

- functional ability of the elderly aged 60 to 90 years in the Mpigi district of central Uganda. *Nutrition*. 2005;21(1):59-66.
5. National Policy for Older Persons. Kampala: Ministry of Gender Labour and Social Development, April 2009.
 6. Scholten F, Mugisha J, Seeley J, et al. Health and functional status among older people with HIV/AIDS in Uganda. *BMC Public Health*. 2011;11:886.
 7. Nyirenda M, Newell ML, Mugisha J, et al. Health, well-being, and disability among older people infected or affected by HIV in Uganda and South Africa. *Global Health Action*. 2013;6:19201.
 8. Kasedde S, Doyle AM, Seeley JA, Ross DA. They are not always a burden: older people and child fostering in Uganda during the HIV epidemic. *Social Science & Medicine*. 2014;113:161-8. PubMed.
 9. Mugisha JO, Schatz E, Seeley J, Kowal P. Gender perspectives in care provision and care receipt among older people infected and affected by HIV in Uganda. *African journal of AIDS research: AJAR*. 2015;14(2):159-67. PubMed.
 10. Siedner MJ, Kim JH, Nakku RS, et al. HIV infection and arterial stiffness among older-adults taking antiretroviral therapy in rural Uganda. *Aids*. 2016;30(4):667-70.
 11. Negin J, Geddes L, Brennan-Ing M, Kuteesa M, Karpiak S, Seeley J. Sexual Behavior of Older Adults Living with HIV in Uganda. *Archives of Sexual Behavior*. 2016;45(2):441-9.
 12. Mayega RW, Guwatudde D, Makumbi F, et al. Diabetes and pre-diabetes among persons aged 35 to 60 years in eastern Uganda: prevalence and associated factors. *PloS One*. 2013;8(8):e72554.
 13. Wandera SO, Kwagala B, Ntozi J. Prevalence and risk factors for self-reported non-communicable diseases among older Ugandans: a cross-sectional study. *Global Health Action*. 2015;8:27923.
 14. Wandera SO, Ntozi J, Kwagala B. Prevalence and correlates of disability among older Ugandans: evidence from the Uganda National Household Survey. *Global Health Action*. 2014;7:25686.
 15. Mugisha JO, Baisely K, Seeley J, Kuper H. The impact of anaemia on functioning in older people in a rural population in South West Uganda. *British Journal of Haematology*. 2014;167(4):580-3.
 16. Wandera SO, Kwagala B, Ntozi J. Determinants of access to healthcare by older persons in Uganda: a cross-sectional study. *International Journal for Equity in Health*. 2015;14:26.
 17. Wandera SO, Golaz V, Kwagala B, Ntozi J. Factors associated with self-reported ill health among older Ugandans: a cross sectional study. *Archives of Gerontology and Geriatrics*. 2015;61(2):231-9.
 18. Rose J, Chang DC, Weiser TG, Kassebaum NJ, Bickler SW. The role of surgery in global health: analysis of United States inpatient procedure frequency by condition using the Global Burden of Disease 2010 framework. *PloS One*. 2014;9(2):e89693.
 19. Stewart B, Khanduri P, McCord C, et al. Global disease burden of conditions requiring emergency surgery. *The British Journal of Surgery*. 2014;101(1):e9-22.
 20. Brown NA, Zenilman ME. The impact of frailty in the elderly on the outcome of surgery in the aged. *Advances in Surgery*. 2010;44:229-49. PubMed.
 21. Zenilman ME, Chow WB, Ko CY, et al. New developments in geriatric surgery. *Current Problems in Surgery*. 2011;48(10):670-754.
 22. Meara JG, Leather AJ, Hagander L, et al. Global Surgery 2030: evidence and solutions for achieving health, welfare, and economic development. *Lancet*. 2015;386(9993):569-624.
 23. Linden AF, Sekidde FS, Galukande M, Knowlton LM, Chackungal S, McQueen KA. Challenges of surgery in developing countries: a survey of surgical and anesthesia capacity in Uganda's public hospitals. *World Journal of Surgery*. 2012;36(5):1056-65.
 24. Firth P, Ttendo S. Intensive care in low-income countries—a critical need. *The New England Journal of Medicine*. 2012;367(21):1974-6.
 25. Uganda Bureau of Statistics. National Population and Housing Census 2014: Main Report. Government of Uganda; 2016.
 26. Anokbonggo WW, Ogwal-Okeng JW, Obua C, Aupont O, Ross-Degnan D. Impact of decentralization on health services in Uganda: a look at facility utilization, prescribing and availability of essential drugs. *East African Medical Journal*. 2004;Suppl:S2-7.
 27. Ministry of Health. Health Sector Performance 2014-2015. Government of Uganda, 2015.
 28. ICF International and Uganda Bureau of Statistics. Uganda Demographic and Health Survey 2011. Kampala, Uganda and Calverton, Maryland, USA; 2012.
 29. Butler EK, Tran, T.M., Fuller, A.T., et al. Pilot study

- of a population-based survey to assess the prevalence of surgical conditions in Uganda. *Surgery*. 2015.
30. Fuller AT, Butler EK, Tran TM, et al. Surgeons Overseas Assessment of Surgical Need (SOSAS) Uganda: Update for Household Survey. *World Journal of Surgery*. 2015.
31. Wong EG, Kamara TB, Groen RS, Zogg CK, Zenilman ME, Kushner AL. Prevalence of surgical conditions in individuals aged more than 50 years: a cluster-based household survey in Sierra Leone. *World Journal of Surgery*. 2015;39(1):55-61.
32. Stewart BT, Wong E, Gupta S, et al. Surgical need in an aging population: A cluster-based household survey in Nepal. *Surgery*. 2015;157(5):857-64.
33. Ageing in the Twenty-First Century: A Celebration and A Challenge. New York and London: United Nations Population Fund and HelpAge International, 2012.
34. Turrentine FE, Wang H, Simpson VB, Jones RS. Surgical risk factors, morbidity, and mortality in elderly patients. *Journal of the American College of Surgeons*. 2006;203(6):865-77.
35. Schwartz JI, Dunkle A, Akiteng AR, et al. Towards reframing health service delivery in Uganda: the Uganda Initiative for Integrated Management of Non-Communicable Diseases. *Global Health Action*. 2015;8:26537.
36. Galukande M, von Schreeb J, Wladis A, et al. Essential surgery at the district hospital: a retrospective descriptive analysis in three African countries. *PLoS Medicine*. 2010;7(3):e1000243.
37. Kruk ME, Wladis A, Mbembati N, et al. Human resource and funding constraints for essential surgery in district hospitals in Africa: a retrospective cross-sectional survey. *PLoS Medicine*. 2010;7(3):e1000242.
38. Grimes CE, Bowman KG, Dodgion CM, Lavy CB. Systematic review of barriers to surgical care in low-income and middle-income countries. *World Journal of Surgery*. 2011;35(5):941-50.
39. Schafer MH. Discussion networks, physician visits, and non-conventional medicine: probing the relational correlates of health care utilization. *Social Science & Medicine*. 2013;87:176-84. PubMed.
40. Linden AF, Maine RG, Hedt-Gauthier BL, et al. Validation of a community-based survey assessing nonobstetric surgical conditions in Burera District, Rwanda. *Surgery*. 2016.
41. Bagonza J, Rutebemberwa E, Bazeyo W. Adherence to anti diabetic medication among patients with diabetes in eastern Uganda; a cross sectional study. *BMC health services research*. 2015;15:168.
42. Bachani AM, Galiwango E, Kadobera D, et al. Characterizing disability at the Iganga-Mayuge Demographic Surveillance System (IM-DSS), Uganda. *Disability and rehabilitation*. 2016;38(13):1291-9.