

# Surgical need among the ageing population of Uganda

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## 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.

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## 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 2050<sup>1</sup>. 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 counterparts<sup>2</sup>. In Uganda, individuals remain economically productive well into advanced years, thus those living with moderate to severe disabilities experience some degree of community marginalization<sup>3,4</sup>. 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,<sup>5</sup>. The policy calls for focused health studies on the elderly population; to date, studies have been predominantly focused on the burden of HIV/AIDS<sup>6-11</sup>, diabetes and stroke and their risk factors<sup>4,12-15</sup>, and health care seeking behavior<sup>16,17</sup>.

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 disability<sup>14</sup> and musculoskeletal diseases<sup>2</sup>, which have the highest frequency of operative intervention<sup>18</sup>. Surgical care for older adults differs than younger age groups: (1) co-morbidities are much more prevalent with increasing age<sup>19</sup>, (2) longer length of hospitalization is required for major operations as well as higher incidence of indications for critical care, and lengthier process of rehabilitation<sup>20</sup>, and (3) older adults are more likely to require end-of-life care for terminal diseases<sup>21</sup>. Surgical capacity in low-income countries, such as Uganda, is far from adequate given the world's poorest third deliver 6% of annual surgical procedures<sup>22</sup>. Surgical capacity of large government hospitals in Uganda is well below the standards recommended by the WHO<sup>23</sup> and critical care infrastructure is in dire need<sup>24</sup>.

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 inhabitants<sup>25</sup> where the health system is coordinated and organized by the national and District-level governments through a shared-governance system<sup>26</sup>. 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 Hospitals<sup>27</sup>. 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-Regions<sup>28</sup>. 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 District<sup>29</sup>. 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 study<sup>30</sup>.

### 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<sup>31,32</sup>. 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 20<sup>th</sup> August 2014 and 12<sup>th</sup> 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 definitions<sup>28</sup>. 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.<sup>30</sup> 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

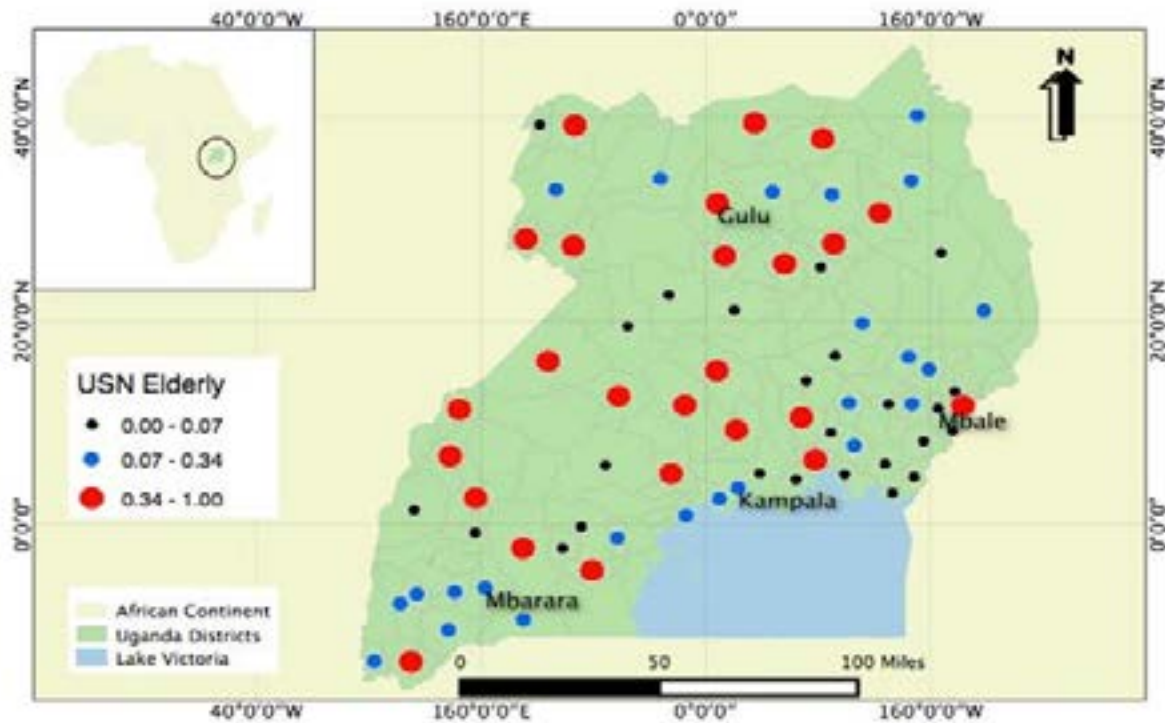
†Time in minutes

‡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<sup>1,25</sup>, 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.

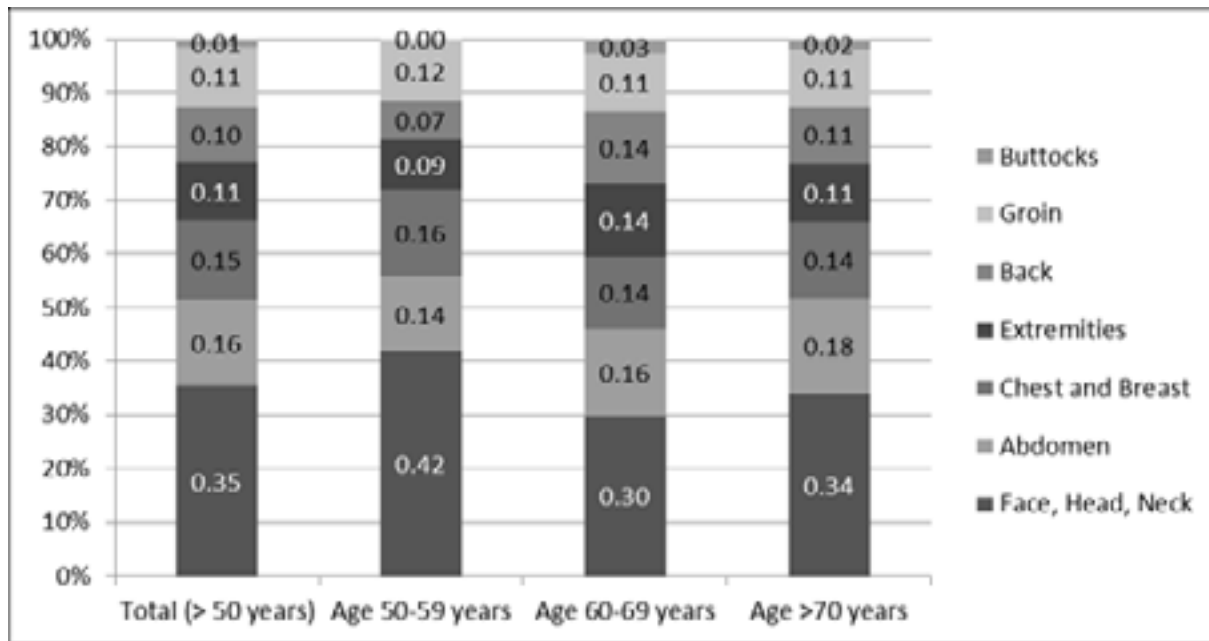
**Table 3: Existing surgically treatable conditions among respondents age 50 years and older (N = 136)**

	Total (≥50 years)	50-59 years	60-69 years	≥ 70 years
<b>Existing surgically treatable condition</b>	136	43	37	56
<b>Sought healthcare</b>				
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)			
<b>If no care, why?</b>	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
<b>Type of surgically treatable condition</b>	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 8<sup>th</sup> 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)**

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

## 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<sup>5,33</sup>, 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<sup>17,34</sup>. 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 platform<sup>35</sup>. Existing limitations in surgical capacity should not be a deterrent to investments<sup>23,36,37</sup>; 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 workforce<sup>21</sup>.

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 adults<sup>38</sup>. 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<sup>2,8</sup>. 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 7<sup>th</sup> and 8<sup>th</sup> 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 support<sup>39</sup>, 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<sup>4,6</sup> 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)<sup>14,16</sup>. For individuals with greater financial means, systems for risk pooling must be created and is recommended by the Lancet Commission on Global Surgery<sup>22</sup>.

This is the third analysis of surgical burden in an ageing population from a low-income country<sup>31,32</sup>, 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 providers<sup>31</sup>. While Nepal has higher physicians per capita, the mountainous terrain throughout the country poses considerably greater geographical barriers to accessing care<sup>32</sup>. 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 underreported<sup>40</sup>, 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-health<sup>17</sup>. 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)<sup>1</sup>, 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 time<sup>13</sup>. 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<sup>41,42</sup>.

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### Conflict of interest

None.

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