

## Prevalence of Surgical Conditions in Individuals Aged More Than 50 Years: A Cluster-Based Household Survey in Sierra Leone

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### Abstract

**Background** With the demographic transition disproportionately affecting developing nations, the healthcare burden associated with the elderly is likely to be compounded by poor baseline surgical capacity in these settings. We sought to assess the prevalence of surgical disease and disability in the elderly population of Sierra Leone to guide future development strategies.

**Methods** A cluster randomized, cross-sectional household survey was carried out countrywide in Sierra Leone from January 9th to February 3rd 2012. Using a standardized questionnaire, household member demographics, deaths occurring during the previous 12 months, and presence of any current surgical condition were elucidated. A retrospective analysis of individuals aged 50 and over was performed.

**Results** The survey included 1,843 households with a total of 3,645 respondents. Of these, 13.6 % (496/3,645)

were aged over 50 years. Of the elderly individuals in our sample, 301 (60.7 %) reported a current surgical condition. Of current surgical disease identified among elderly individuals ( $n = 530$ ), 349 (65.8 %) described it as disabling, and 223 (42.1 %) sought help from traditional medicine practitioners. Women (odds ratio [OR] 0.60; 95 % confidence interval [CI] 0.40–0.90) and individuals living in urban settings (OR 0.44, 95 % CI 0.26–0.75) were less likely to report a current surgical problem. Of the 230 elderly deaths in the previous year, 83 (36.1 %) reported a surgical condition in the week prior.

**Conclusions** The unmet burden of surgical disease is prevalent in the elderly in low-resource settings. This patient population is expected to grow significantly in the coming years, and more resources should be allocated to address their surgical needs.

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## Introduction

The demographic transition is a global phenomenon. By 2050, an estimated 2 billion people will be aged 60 years and over [1], with 400 million of them aged over 80 years [2]. In this time period, 80 % of elderly individuals will be living in low-to middle-income countries (LMICs) [2]. Concurrently, the epidemiological transition is occurring in these settings. By 2030, noncommunicable diseases (NCDs) will account for more deaths than infectious, maternal, perinatal, and nutritional diseases combined in LMICs [3], many of which will require surgical care.

The healthcare burden generated by these transitions will be compounded by poor baseline access to surgical care. In fact, of an estimated 234 million surgeries performed globally each year, only 3.5 % are performed in low-resource settings [4]. Furthermore, the unmet burden of surgical disease in these settings is already significant. For example, an estimated 25 % of the population of Sierra Leone are living with an untreated surgical condition, and almost 25 % of deaths in the previous year could have been averted by timely surgical care [5].

Surgical care for the elderly differs significantly from the care of younger individuals. Patients often have altered physiological response secondary to multiple comorbidities and present more often as emergency cases [6]. Moreover, as geriatric patients often require more prolonged rehabilitation and may have altered goals of treatment, such as palliation and relief of suffering, the use of multidisciplinary teams has been promoted [7]. Therefore, surgical care for the elderly undoubtedly requires extensive resources, and future planning strategies will depend on baseline assessment of surgical need.

However, although the widespread prevalence of chronic NCDs and disability has been documented in LMICs [8, 9], the burden of surgical disease in the elderly has yet to be quantified in these settings. In this context, this study aimed to assess the prevalence of surgical disease and disability in the population of Sierra Leone and to identify potential risk factors to guide future development strategies.

## Materials and methods

Detailed study methods have previously been published [5]. Briefly, this study was part of the Surgeons OverSeas Assessment of Surgical Need (SOSAS) in Sierra Leone. This cluster randomized, cross-sectional household survey was carried out countrywide from January 9th to February 3rd 2012. A pilot survey was initially carried out in this setting [10]. Based on the findings, the calculated sample size was 3,745 individual respondents.

Sierra Leone has 9,671 enumeration areas (the smallest administrative unit in Sierra Leone), of which 75 were randomly selected with a probability proportional to the population within each unit. In each enumeration area, 25 households were randomly chosen and two members within each household were randomly selected for a detailed interview. Household members were defined as individuals who slept in the same structure the night before and who ate from the same pot, the same definition used by the Demographic and Health Survey (DHS) [11].

The survey was administered by students from the Faculty of Nursing and College of Medicine and Allied Health Sciences of Sierra Leone and staff from Statistics Sierra Leone via hand-held tablets.

The survey comprises two parts. Initially, a household member is questioned regarding the number of household members, the occurrence of any deaths in the household in the previous year, and the presence of any symptoms in the week before death that may have been associated with a surgical disease. The second section was then conducted on two randomly selected household members, and included a verbal examination covering six anatomical regions: head, neck, and face; chest; abdomen; groin; back; and extremities.

For the purposes of this study, elderly individuals were defined as being aged 50 years or older as suggested by the World Health Organization (WHO) [12]. Although most developed countries define the elderly as 65 years and older based on the retirement age, the lack of formal retirement benefits in less developed settings makes it difficult to apply this definition. Given lower life expectancies and smaller elderly populations in LMICs, a definition based on changes in physical capabilities and social roles (i.e. changes in work patterns) is preferred. The proposed working definition of an older person in Africa is therefore set at 50 years of age. Although this may introduce difficulties in data comparability across countries, this definition appears to be a better representation of cultural and functional factors in these settings.

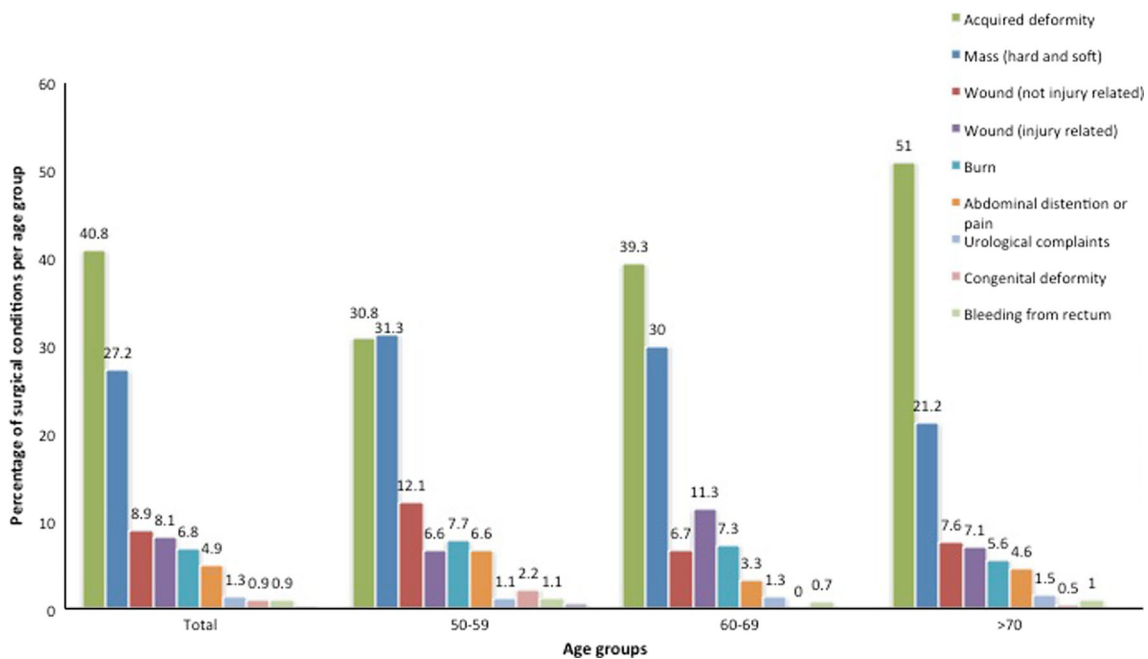
Statistical analysis was performed using STATA 13 (StataCorp LP, College Station, TX, USA). Proportions are reported with 95 % confidence intervals (CIs). Multivariate logistic regression analysis was performed to identify potential differences between respondents with or without a current surgical disease. Odds ratios (ORs) are also reported with 95 % CIs. Intervals that do not include 1.0 were considered statistically significant.

Ethical approval for this study was obtained from the Ethical and Scientific Review Committee of Sierra Leone and the Research Ethics Committee of the Royal Tropical Institute in Amsterdam. Informed consent was obtained from all involved community leaders, heads of each household interviewed, and all individual respondents.

**Table 1** Basic demographic information of patients aged 50 and over in the Surgeons Overseas Assessment of Surgical Need (SOSAS) in Sierra Leone

Demographic	Total		Patients aged 50–59 y		Patients aged 60–69 y		Patients aged > 70 y	
	n (%)	95 % CI	n (%)	95 % CI	n (%)	95 % CI	n (%)	95 % CI
<b>Gender</b>								
Male	241 (48.6)	43.7–53.4	111 (52.9)	45.4–60.3	64 (45.3)	37.0–53.8	66 (45.5)	36.7–54.3
Female	255 (51.4)	46.6–56.2	99 (47.1)	39.7–54.6	77 (54.6)	46.2–63.0	79 (54.5)	45.6–63.3
<b>Residency</b>								
Urban	150 (30.2)	19.3–41.2	71 (33.8)	21.4–46.2	39 (27.6)	15.3–40.0	40 (27.6)	15.5–39.7
Rural	346 (69.8)	58.8–80.7	139 (66.2)	53.8–78.9	102 (72.3)	60.0–84.7	105 (72.4)	60.3–84.5

CI confidence interval



**Fig. 1** Reported current conditions requiring surgical care in patients aged 50 and over in the Surgeons Overseas Assessment of Surgical Need (SOSAS) in Sierra Leone

**Results**

Of the 1,875 randomly selected households, 30 were excluded due to inconsistencies and incomplete information and two were excluded because of refusal to give consent. Consequently, 1,843 households were retained for data analysis, representing a 98.3 % response rate. After exclusions, the expected number of interviewed individuals was 3,686. However, data were only available for a single member of the household in 41 interviews, resulting in 3,645 actual respondents.

Of these participants, 13.6 % (496/3,645) were aged over 50 years. Men represented 48.6 % (241/496) of this population, while 51.4 % (255/496) were female. Of the elderly participants, 150 (30.2 %) lived in urban areas,

while 346 (69.8 %) lived in rural areas. Table 1 presents the stratified demographics with corresponding 95 % CIs.

Of the elderly individuals in our sample, 352 (71.0 %) reported at least one surgical problem in their lives, and 301 (60.7 %) reported a current surgical condition.

The most common reported conditions requiring surgical care were an acquired deformity and a soft or hard mass, accounting for 40.8 % (95 % CI 35.7–45.8) and 27.2 % (95 % CI 21.9–32.5) of all reported surgical issues, respectively (Fig. 1). Furthermore, these conditions most commonly affected the head, face, and neck (26.8 %; 95 % CI 23.2–30.4) and the extremities (24.2 %; 95 % CI 20.6–27.7) (Table 2).

Of current surgical disease identified among elderly individuals (n = 530), 349 (65.8 %) described it as

**Table 2** Anatomical location of current conditions requiring surgical care in patients aged 50 and over in the Surgeons Overseas Assessment of Surgical Need (SOSAS) in Sierra Leone

Anatomical location	Total		Patients aged 50–59 y		Patients aged 60–69 y		Patients aged > 70 y	
	n (%)	95 % CI	n (%)	95 % CI	n (%)	95 % CI	n (%)	95 % CI
Abdomen	67 (12.6)	9.9–15.3	28 (15.3)	10.0–20.6	19 (12.7)	7.9–17.5	20 (10.2)	6.4–13.9
Head, face, neck	142 (26.8)	23.2–30.4	42 (23.0)	27.6–28.3	44 (29.3)	21.5–37.2	56 (28.4)	21.7–35.2
Arms, hands, legs, and feet	128 (24.2)	20.6–27.7	43 (23.5)	17.4–29.6	32 (21.3)	15.4–27.3	53 (26.9)	20.6–33.2
Groin, genitals, buttocks	75 (14.2)	11.3–17.0	31 (16.9)	11.7–22.2	22 (14.7)	9.1–20.2	22 (11.2)	7.2–15.2
Chest, breast	55 (10.4)	7.8–12.9	22 (12.0)	7.4–16.6	12 (8.0)	4.5–11.4	21 (10.7)	6.3–15.0
Back	63 (11.9)	9.2–14.5	17 (9.3)	5.4–13.2	21 (14.0)	9.4–18.6	25 (12.7)	7.9–17.5
Total	530		183		150		197	

CI confidence interval

**Table 3** Multivariate logistic regression analysis comparing respondents with or without a current surgical problem in patients aged 50 and over in the Surgeons Overseas Assessment of Surgical Need (SOSAS) in Sierra Leone

Demographic	No surgical problem identified, n (%)	At least one current surgical problem, n (%)	Crude OR	95 % CI	p value
Gender					
Male	80 (41.0)	161 (53.5)	REF	REF	0.014*
Female	115 (59.0)	140 (46.5)	0.60	0.40–0.90	
Residency					
Rural	115 (59.0)	231 (76.7)	REF	REF	0.003*
Urban	80 (41.0)	70 (23.3)	0.44	0.26–0.75	
Age group (y)					
50–60	87 (44.6)	123 (40.9)	REF	REF	0.030*
60–70	63 (32.3)	78 (25.9)	0.86	0.53–1.38	
>70	45 (23.1)	100 (33.2)	1.58	0.98–2.57	
Total	195	310			

CI confidence interval, OR odds ratio

disabling. Secondary to this disease, 53 (10.0 %) required assistance with activities of daily living (ADLs), 19 (3.6 %) required help with transportation and 214 (40.4 %) were unable to work as previously.

Of the current surgical problems reported by elderly individuals, 258 (48.7 %) sought healthcare, and 223 (42.1 %) sought help from traditional medicine practitioners. When questioning elderly individuals with current surgical problems who did not seek healthcare ( $n = 272$ ), the main reasons cited were lack of financial resources for healthcare (160; 58.8 %) and for transport (4; 1.5 %), lack of time (5; 1.8 %) and trust in the healthcare facility (12; 4.4 %), no access to a skilled healthcare worker (31; 11.4 %), or no need for medical care as deemed by the individual (60; 22.1 %).

Multivariate logistic regression analysis revealed that female participants (OR 0.60; 95 % CI 0.40–0.90) and individuals living in urban settings (OR 0.44, 95 % CI 0.26–0.75) were less likely to report a current surgical problem (Table 3). Moreover, older age was associated

with an increased likelihood of having a current surgical problem ( $p = 0.03$ ).

Upon further analysis, 39.9 % (95 % CI 32.6–47.2) of the elderly had never undergone a surgical procedure (Table 4). During their lifetime, 12.4 % (95 % CI 7.6–17.3) had undergone a major procedure and 41.6 % (95 % CI 33.9–49.4) had undergone a minor procedure.

Of the individuals who died in the previous year ( $n = 703$ ), 230 (32.7 %) were over 50 years of age. Of these, 83 (36.1 %) reported a surgical condition in the week prior to their deaths. The most common presentations were abdominal distention or pain (51.8 %; 95 % CI 41.1–62.5); injury (15.7 %; 95 % CI 7.9–23.4); and a mass, growth, or swelling (14.5 %; 95 % CI 6.8–22.1) (Fig. 2).

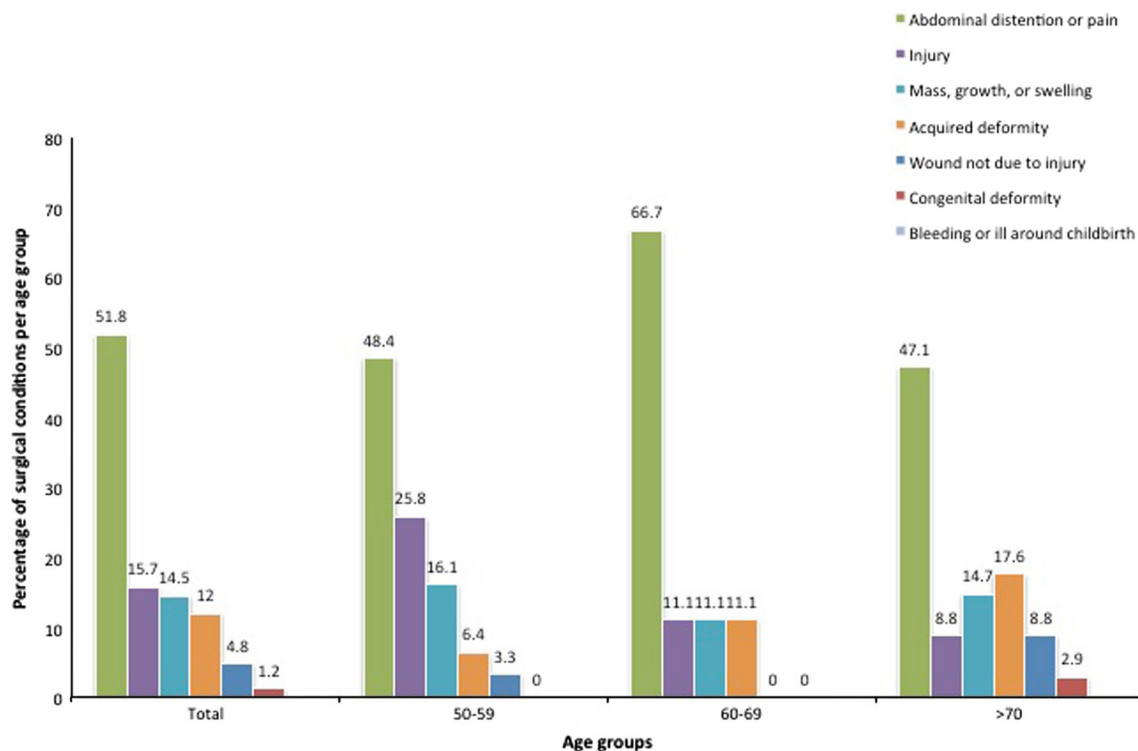
## Discussion

The provision of surgical care to the elderly has evolved considerably in the past decade. Initially, the increased

**Table 4** Lifetime cumulative incidence of interventions in patients aged 50 and over in the Surgeons Overseas Assessment of Surgical Need (SOSAS) in Sierra Leone

Intervention	Total		Patients aged 50–59 y		Patients aged 60–69 y		Patients aged > 70 y	
	n (%)	95 % CI	n (%)	95 % CI	n (%)	95 % CI	n (%)	95 % CI
No procedure	93 (39.9)	32.6–47.2	48 (44.0)	33.9–54.1	20 (31.7)	19.4–44.1	25 (41.0)	27.4–54.6
Major procedure	29 (12.4)	7.6–17.3	13 (11.9)	5.1–18.8	6 (9.5)	2.4–16.7	10 (16.4)	6.3–26.5
Minor procedure	97 (41.6)	33.9–49.4	42 (38.5)	28.1–49.0	33 (52.4)	38.4–66.3	22 (36.0)	22.6–49.6
Cesarean section	1 (0.4)	0.0–1.3	0 (0.0)	–	1 (1.6)	0.0–4.8	0 (0.0)	–
Orthopedic manipulation/casting	1 (0.4)	0.0–1.3	1 (0.9)	0.0–2.8	0 (0.0)	–	0 (0.0)	–
Orthopedic traction	12 (5.2)	1.4–8.9	5 (4.6)	0.0–9.3	3 (4.8)	0.0–10.0	4 (6.6)	0.0–14.4

CI confidence interval

**Fig. 2** Conditions of deceased household members that might have been averted with surgical care, as occurring in the week before death, in the Surgeons Overseas Assessment of Surgical Need (SOSAS) in Sierra Leone

morbidity and mortality associated with surgery in the elderly was thought to be due to the concomitant increase in comorbid illness [6]. More recently, age has been suggested to be an independent risk factor for peri-operative morbidity and mortality [13]. Systemic factors, including failure to recognize and treat conditions unique to the elderly population, such as frailty, delirium, and polypharmacy, have been identified as potential etiologies for these disparities in outcomes [7]. The implementation of multidisciplinary teams, increasing access to rehabilitation facilities, and the training of surgeons specifically for the care of the elderly are measures that have been brought forward to address these issues [7].

However, given the paucity of baseline resources available for surgical care in LMICs [14–17], and the resource-intensive nature of this population group, it is likely that the surgical needs of the elderly are not being met. In fact, this study shows a prevalence of surgical disease of over 60 % in the elderly population of Sierra Leone, with an estimated 36.1 % of elderly deaths in the previous year that may have been averted by timely surgical care. With the demographic transition predicted to disproportionately occur in developing nations [2], the unmet burden of surgical disease in the elderly is likely to increase substantially if efforts are not made to address these deficiencies.

Furthermore, the role of the elderly in low-resourced communities is increasingly important. In fact, with the growing economic migration towards urban areas in these settings, an increasing number of elderly individuals are becoming the primary caregivers of the family's young children [18]. This effect is compounded by the burden of HIV/AIDS and conflict in these settings [19]. The elderly are also commonly perceived as leaders in these communities. In this study, 42.1 % of elderly individuals sought care from an alternative medical practitioner for surgical diseases. It is possible that an increase in surgical capacity could facilitate access to surgical care in the elderly, which would have reverberating effects on attitudes towards surgery in the communities.

Few studies have addressed NCDs of the elderly in LMICs. Phaswana-Mafuya et al. [8] recently evaluated the self-reported prevalence of chronic NCDs in the elderly population of South Africa. However, surgical diseases such as cancer were not addressed. Iloh et al. [20] performed a hospital-based assessment of the most common geriatric emergencies in South Eastern Nigeria: obstructed or strangulated hernias and injuries represented 5.1 and 13.4 % of all geriatric emergencies, respectively. The burden of surgical diseases appeared high despite the underestimation associated with hospital-based data.

In this context, this study is the first population-based evaluation of surgical need of the elderly in LMICs. This large household-based survey demonstrates an important prevalence of surgical disease and a considerable amount of deaths that could have been averted by proper surgical care. In the context of a growing elderly population, resources should be allocated to augmenting baseline surgical capacity, improving access to multidisciplinary teams and community-based educational activities.

This study has several limitations. First, the household survey solely relied on a verbal interview. Although a physical exam would have been ideal, it was not performed due to important cultural, ethical, and financial factors. The survey therefore relied on the participant's self-reported illnesses. Designed for non-clinicians in a developing nation, this survey kept disease definitions purposefully simple so as to encourage response and to keep the respondents engaged and not confused regarding the actual clinical diagnoses. Nevertheless, the verbal data as presented strongly suggests that hernias, abdominal masses, and neck masses are areas to focus upon when training staff to care for patients in these settings. A second related limitation was the lack of definitive diagnostic tools to corroborate the illnesses reported by the elderly individuals. A neck mass, for example, would not necessarily require a surgical intervention. This would therefore lead to an overestimation of the prevalence of surgical disease. However, it is likely that such a symptom would require at

least a surgical consultation. Therefore, efforts to build surgical capacity should take the prevalence of these symptoms into account. Finally, given that the report of deaths possibly related to a surgically amenable disease relied solely on surveys of the participants, there is a possibility of recall bias. This could lead to overestimation of these deaths by remembering a tragic death as occurring more recently than actually occurred. However, surgically related symptoms could also be forgotten, thus leading to an underestimation of deaths that could have been averted by surgical care.

Nevertheless, this study is an important first step in quantifying the burden of surgical disease in the elderly in LMICs. Future studies should address in-hospital procedures, quality of care, and outcomes evaluations. Comparisons should be made with higher-income settings in order to quantify the excess burden of disease, although a population-based prevalence of untreated surgical disease in better-resourced areas, to our knowledge, is unavailable at this time. Ultimately, efforts should be made to address the specific needs of the elderly population requiring surgical interventions in LMICs.

## Conclusion

The unmet burden of surgical disease is prevalent in the elderly in low-resource settings. This patient population is expected to grow significantly in the coming years, and more resources should be allocated to address their surgical needs.

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