Out-patient visits for gastrointestinal cancer at a quaternary South African hospital–trends and geospatial distribution

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Abstract:

Background: This study sought to determine trends in out-patient visits for gastrointestinal cancer (GC) at a quaternary hospital in KwaZulu-Natal (KZN), South Africa; and identify geographical regions which contribute most to GC-related out-patient clinic utilization at this hospital.

Method: Data for GC-related outpatient visits over an 11-year period was obtained from the hospital's administrative database. Trends were analyzed using simple regression and trend line analyses. Patient residential postal codes from the administrative database were used to determine the geospatial distribution of complex GC in KZN.

Results: Strong increasing trends in GC-related out-patient visits were noted for age >65 years old (R^2=0.8014), male (R^2=0.7020), female (R^2=0.7292), lower GC (R^2=0.7094), and rural residence (R^2=0.7008). Moderate increasing trends in GC-related out-patient visits were noted for age ≤65 years old (R^2=0.6556), upper GC (R^2=0.6498), and urban residence (R^2=0.6988). The magnitude at which the number of out-patient visits increased was greater for urban residence when compared with rural residence (p=0.006). Urban centers and some regions along the North and South coast of KZN contributed the most toward GC-related out-patient visits.

Conclusion: Out-patient visits for complex GC in KZN are increasing. Several regions have been identified for anti-cancer interventions and decentralized out-patient services.

Keywords: Gastrointestinal cancer, out-patient visits, quaternary hospital, South Africa.

DOI: https://dx.doi.org/10.4314/ahs.v20i1.41

Cite as: *Moodley Y, Madiba T. Out-patient visits for gastrointestinal cancer at a quaternary South African hospital–trends and geospatial distribution. Afri Health Sci. 2020;20(1):359-67. https://dx.doi.org/10.4314/ahs.v20i1.41*

Introduction

Gastrointestinal cancer (GC) is an important cause of morbidity and mortality[1-3]. The incidence of GC in the South African (SA) population varies by the site of the cancer, gender, and ethnicity[4]. Although there are differences in the incidence of the various GCs in SA, there is no doubt that all GCs are associated with high mortality in this setting[3,4]. Unfortunately, many patients make their first visits to district or regional hospitals for GC diagnosis and treatment when their disease has reached an advanced stage[5]. These lower level health care facilities might lack the appropriate resources to effectively diagnose and manage these advanced, and often complex GC cases[6]. Herein lies the importance of the specialist healthcare services offered by quaternary-level hospitals. However, quaternary-level hospitals and the services they offer are a scarce resource[7], and there is yet to be a report of resource utilization for GCs at a SA quaternary hospital.

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Out-patient clinic visits have been used as a measure of healthcare utilization in GC populations[8,9]. Further, out-patient clinic visits would have an added relevance to GC management at a quaternary hospital for two main reasons. Firstly, in many patients GCs are a chronic condition and management often involves several years of treatment and follow-up on an out-patient basis[10]. Secondly, there are some aspects of out-patient care which in theory have the potential to be successfully decentralized to lower level healthcare facilities without the need for specialist physicians[11,12], placing less burden on the resources of the quaternary hospital. An understanding of which geographical regions contribute the most to GC-related out-patient visits at the quaternary hospital would also assist in developing region-specific interventions which might reduce the burden of GCs on the resources of the quaternary hospital. Therefore, the objectives of this study were to determine trends in outpatient clinic visits for GC at a quaternary SA hospital, and identify geographical regions which contribute most to GC-related outpatient clinic utilization at this hospital.

Methods

Study design and setting

This was an analysis of outpatient visit data from the administrative system of the quaternary-level, Inkosi Albert Luthuli Central Hospital (IALCH) located in Durban, SA. This 850-bed facility offers specialist inpatient and outpatient services to the ethnically diverse population of the KwaZulu-Natal (KZN) province, SA. As it is the sole quaternary hospital in KZN, patient access to services at IALCH is usually based on referral from lower level healthcare facilities. These lower level healthcare facilities include regional and tertiary hospitals in the metropolitan areas of Durban on the coast, and Pietermaritzburg in the midlands region.

Study sample

All adult outpatient visits at IALCH between 01 January 2006 and 31 December 2017 with an International Classification of Disease 10th Revision (ICD-10) primary diagnosis code indicative of GC were included in the study sample. A detailed description of these ICD-10 codes is provided in Table 1. These were categorized as upper GC or lower GC (Table 1). Upper Gastrointestinal Cancer (upper GC) was defined as cancer of the oesophagus, stomach, liver, gall bladder, bile ducts, and pancreas. Lower Gastrointestinal Cancer (lower GC) was defined as cancer of the small or large intestine, rectum, and anus. A decision was made to stratify GC by the site of cancer as the incidence and risk factors between these two categories or cancer can differ. This has implications with regard to the various management and prevention strategies which should be considered for each category of GC cancer.

Table 1. ICD-10 codes used to identify outpatient visits related to GC

Code	Description	Category
C15.9	Malignant neoplasm, oesophagus, unspecified	Upper GC
C16.0	Malignant neoplasm, cardia	Upper GC
C16.1	Malignant neoplasm, fundus of stomach	Upper GC
C16.3	Malignant neoplasm, pyloric antrum	Upper GC
C16.4	Malignant neoplasm, pylorus	Upper GC
C16.5	Malignant neoplasm, lesser curvature of stomach, unspecified	Upper GC
C16.6	Malignant neoplasm, greater curvature of stomach, unspecified	Upper GC
C16.8	Malignant neoplasm, overlapping lesion of stomach	Upper GC
C16.9	Malignant neoplasm, stomach, unspecified	Upper GC
C18.9	Malignant neoplasm, colon, unspecified	Lower GC
C19	Malignant neoplasm of rectosigmoid junction	Lower GC
C20	Malignant neoplasm of rectum	Lower GC
C21.0	Malignant neoplasm, anus, unspecified	Lower GC
C21.1	Malignant neoplasm, anal canal	Lower GC
C21.8	Malignant neoplasm, overlapping lesion of rectum, anus and anal canal	Lower GC
C22.9	Malignant neoplasm, liver, unspecified	Upper GC
C25.0	Malignant neoplasm, head of pancreas	Upper GC
C25.1	Malignant neoplasm, body of pancreas	Upper GC
C25.2	Malignant neoplasm, tail of pancreas	Upper GC
C25.3	Malignant neoplasm, pancreatic duct	Upper GC
C25.4	Malignant neoplasm, endocrine pancreas	Upper GC
C25.7	Malignant neoplasm, other parts of pancreas	Upper GC
C25.8	Malignant neoplasm, overlapping lesion of pancreas	Upper GC
C25.9	Malignant neoplasm, pancreas, unspecified	Upper GC
C75.9	Malignant neoplasm, endocrine gland, unspecified	Upper GC
C78.5	Secondary malignant neoplasm of large intestine and rectum	Lower GC
C78.6	Secondary malignant neoplasm of retroperitoneum and peritoneum	Lower GC
C78.7	Secondary malignant neoplasm of liver and intrahepatic bile duct	Upper GC

GC: Gastrointestinal cancer

Data source and data description

Data for each eligible outpatient visit during the study period was extracted from the administrative database at IALCH. These data included the date of the outpatient visit, the primary ICD-10 code associated with the visit, patient age, gender, and the residential postal code provided by the patient. Rural or urban residence was determined by the patient's postal code which was verified with a list supplied by the South African Postal Service. All data were converted to a Microsoft Excel® spreadsheet, in preparation for the subsequent data analysis.

Data analysis

Descriptive statistics were used to analyze the characteristics of the study sample. Trends in outpatient visits across the study period were determined through simple regression and trend line analysis, with the trends analysis also being stratified by age, gender, GC category, and rural/urban residence. The nature of the trend (ie. increasing or declining) was determined by assessing the slope of the trend line. Declining trends are characterized by a negative trend line slope. Conversely, increasing trends are characterized by a positive trend line slope. The R^2 value from the simple regression analysis was used to determine the strength of a trend ($R^2<0.5000$ = weak trend, $0.5000\leq R^2\leq 0.7000$ = moderate trend, $R^2>0.7000$ = strong trend). All statistical analysis was performed using the appropriate formulae and statistical functions in Microsoft Excel®. A p-value <0.050 was considered to be a statistically significant result.

A qualitative geospatial analysis of GC-related outpatient visits at IALCH was also performed. For this analysis, the previously mentioned residential postal codes provided by patients and the Power Map® add-in software for Microsoft Excel® were used to create maps of KZN, which indicated regions that contributed toward outpatient clinic utilization across the study period. Regions contributing toward GC-related out-patient visits to the study are indicated by purple (upper GI) or green (lower GI) circles on the map. The size of the circles are proportional to the density of out-patient visits related to each broad category of GC for each area.

Ethical approval
This study was approved by the Biomedical Research Ethics Committee of the University of KZN, South Africa (Protocol number: BE595/16).

Results
There were 36 184 GC-related outpatient visits at IALCH between 01 January 2006 and 31 December 2017, which constituted the study sample. This equated to an average of 3 015.3 (Standard deviation: 1 470.3) GC-related outpatient visits per year at IALCH across the study period. There were 3 494 patients who utilized outpatient services for GC at IALCH across the study period, with an average of 10.4 (Standard deviation: 15.1) visits per patient across the study period. The average age of the study sample was 57.4 (Standard deviation: 12.6) years old. A total of 10 167/36 184 (28.1%) out-patient visits were in patients aged >65 years old. Males contributed 49.6% (18 130/36 184) of outpatient visits. With regard to GC classification, 20 059/36 184 (55.4%) outpatient visits were related to lower GC and 16 125/36 184 (44.6%) were related to upper GC. A total of 6 133/36 184 (16.9%) out-patient visits were in patients who resided in rural areas.

Trends in GC-related out-patient visits at IALCH between 01 January 2006 and 31 December 2017 are shown in Figure 1. Overall, there was a strong trend toward an increase in GC-related out-patient visits over the study period (R^2=0.7223). Strong increasing trends in GC-related outpatient visits were noted for age >65 years old (R^2=0.8014), male (R^2=0.7020), female ((R^2=0.7292)), lower GC (R^2=0.7094), and rural residence (R^2=0.7008). Moderate increasing trends in GC-related out-patient visits were noted for age ≤65 years old (R^2=0.6556), upper GC (R^2=0.6498), and urban residence (R^2=0.6988). The magnitude at which the number of out-patient visits increased was greater for urban residence when compared with rural residence (p=0.006).

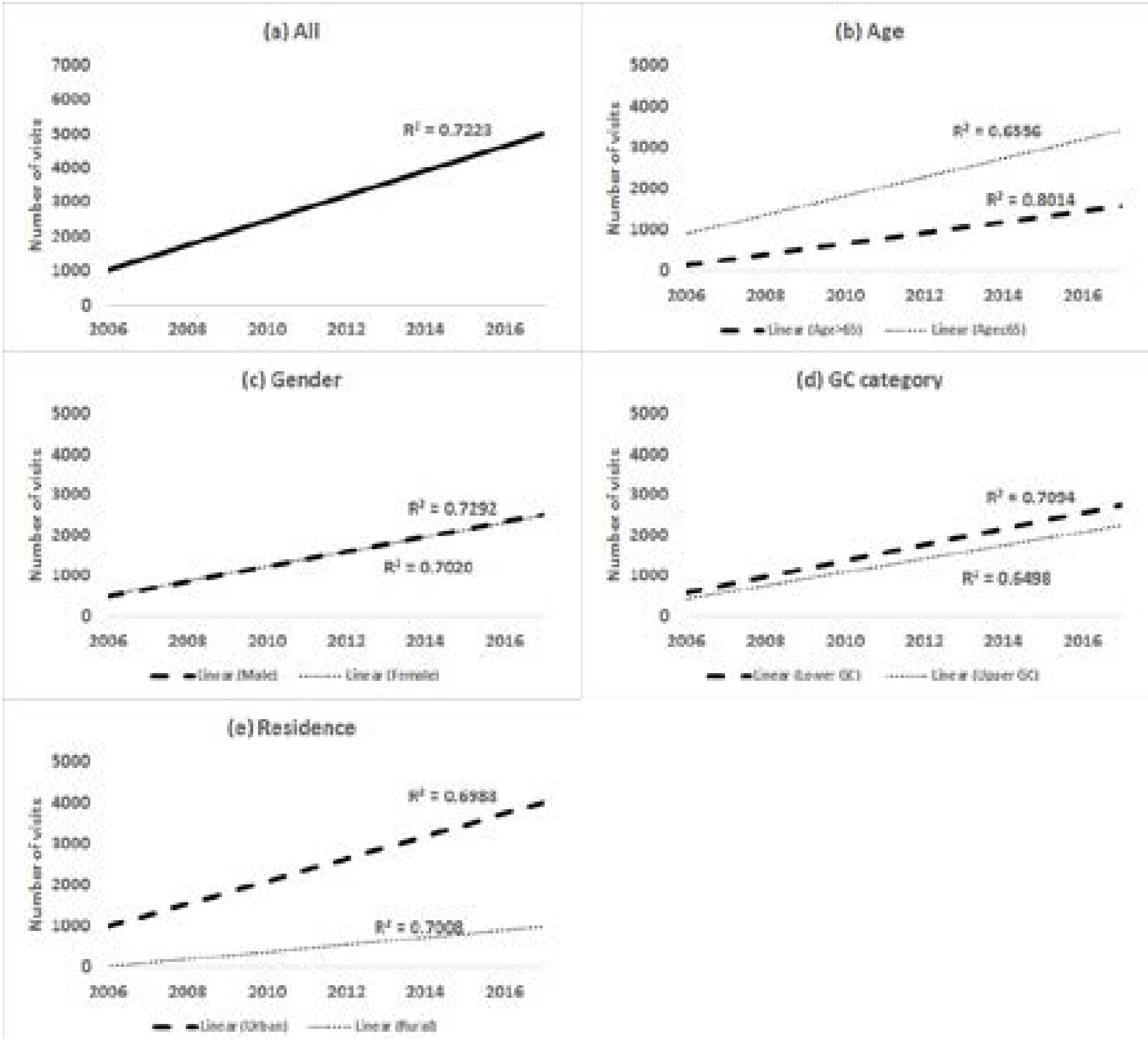

Figure 1. Trends in the number of outpatient visits for GC at IALCH, 2006-2017

GC: Gastrointestinal cancer

Regions of KZN contributing toward GC-related outpatient visits at IALCH during the study period are shown in Figure 2. Overall, there was an overlap in the density of out-patient visits between the two GC categories (Upper and lower GC) for several regions of KZN. The density of upper and lower GC-related out-patient visits was highest around the cities of Durban and Pietermaritzburg. There were also regions with an overlapping intermediate number of upper and lower GC-related outpatient visits noted along the coastline, North toward the town of Kwa-Dukuza and south toward Port Edward. There appeared to be fewer out-patient visits for lower GC (versus upper GC) in the far North and far West of KZN. An intermediate number of upper GC-related outpatient visits was observed for the rural town of Ladysmith in the far west of KZN, with smaller (but still notable) volumes of outpatient visits for upper GC noted for some regions in the far north including the rural Zululand and Umkhanyakude district municipalities.

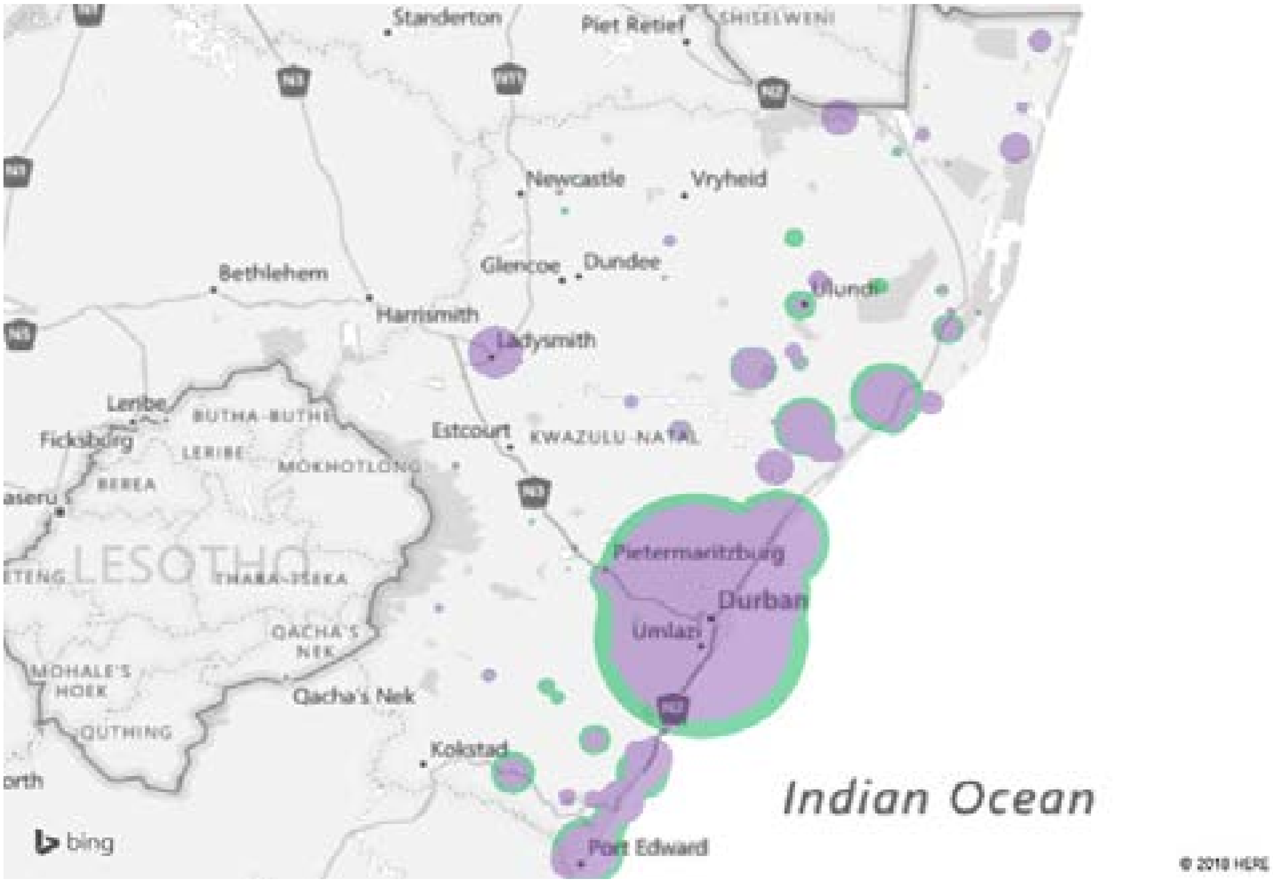

Figure 2. Regions of KwaZulu-Natal province contributing to GC-related outpatient visits at IALCH, 2006-2017*

*Upper GC – purple circles, Lower GC – green circles.

Discussion

Outpatient services utilization for GC increased substantially at IALCH between 2006 and 2017. There are two possible explanations for this finding. Firstly, SA is currently experiencing an epidemiological transition, that being a shift from a traditionally high burden of disease associated with communicable conditions toward a higher burden of non-communicable conditions[13]. This is likely due to the rapid urbanization of the SA population which has occurred since the fall of apartheid[14]. Urbanization is usually accompanied by the adoption of a westernized-lifestyle and an increase in lifestyle-related risk factors for non-communicable conditions[14], which might explain the overall trend observed in this study. A second explanation for the increasing trend in GC-related outpatient visits might be due to improved access to primary healthcare services and improved primary health care practices that identify GC patients for referral to secondary and tertiary hospitals which have been implemented in recent decades.

A larger proportion of outpatient visits in this study were in those aged ≤65 years old. This is an important finding which should be considered when designing health promotion materials in this setting, as these materials should be targeted more toward the younger age group. The proportion of out-patient visits attributed to males and females was similar, suggesting that there is no predilection for gender. There was a higher proportion of out-patient visits for lower GC. However, this is to be expected as lower GCs are amongst the most common cancers in SA[4,15].

The trends analysis revealed an increase in outpatient visits for GC across all categories of variables investigated, indicating that a strong response toward tackling GC in KZN is required. While there were increasing trends noted across all categories of variables investigated, the speed at which the trend progressed in the urban residence group when compared with the rural residence group was striking. Therefore, a response to GC in this setting which also acknowledges this difference and aims to address it would be ideal.

The majority of upper and lower GC-related outpatient visits in this study were attributed to large urban centers such as Durban and Pietermaritzburg. An intermediate number of upper and lower GC-related visits were observed in regions along the north and south coast of KZN which have traditionally been considered as rural areas. This is further evidence of the impact of urbanization, which has spread from the urban center of Durban, on the health of those living along the southern and northern coastlines of KZN. The increasing importance of GC in traditionally rural areas does have implications with regard to planning relevant health promotion activities, in that these activities would also need to be appropriately designed for these areas. Interestingly, there were disproportionately higher levels of upper GC (versus lower GC) reported in the town of Ladysmith in the far west of KZN, and in the far northern regions of KZN. This suggests that while there is an overlap in the oupatient clinic utilization for upper and lower GC in several regions which would benefit from a combined health promotion campaign for both categories of GC, there might still be regions where campaigns for individual GC categories might be more feasible in terms of the resource allocation for these health promotion campaigns.

Health promotion campaigns targeting GC would be required at the primary and secondary levels of prevention. This would reduce the risk of disease, and would also ensure that those who have the disease are timeously diagnosed and treated, such that the disease would not advance to a stage where it requires management at a quaternary-level healthcare facility[16,17]. Interventions at the primary level of prevention usually seek to spark behavioural change toward healthier lifestyle choices in at-risk populations[18]. Educational inteventions which aim to raise awareness of GC and its risk factors would be an obvious choice as a primary prevention intervention. A potential method for delivering this educational intervention would be through the use of trained peers or community health workers[19]. These would ideally be individuals who have had some experience with GC in their lives, for instance a patient who has had GC in the past but has since been cured[19]. Interventions led by peers or community health workers are already being implemented in SA settings for other disease conditions, including HIV[20]. Interventions at the secondary level of prevention usually involve increasing access to diagnostic services, as well as uptake of these services[18]. The geospatial findings of this study suggest that both urban and rural areas in KZN are impacted by GC. Healthcare facilities in rural areas might not have adequate access to diagnostic methods for GC4. However, even in settings where these services are available, there are still barriers which determine whether patients access these services or not. This would include distance to the healthcare facility and the travelling time involved[21]. A secondary prevention intervention which could potentially address these specific barriers is the use of mobile GC clinics[22].

Aside from identifying regions in KZN which could benefit from primary and secondary prevention interventions for GC, the findings of the geospatial analysis also provide an indication of regions of the province which might benefit from health system strengthening activities related to outpatient management of complex GC. Lower level hospitals in these regions can be used as satellite stations of the quaternary level hospital to deliver some of its GC-related services. For example, in a capacity-building approach[23], GC specialists from the quaternary hospital can provide yearly training courses at lower level facitilites in severely impacted regions on how to manage complex GC cases at these facilities. Another approach is for a GC specialist from the quaternary hospital to visit these lower level facilities on a monthly basis and directly assist with the management of complex GC cases[24]. Nurse-led outpatient clinics have also shown to be succesful in addressing aspects of GC in overseas settings[25,26], and this is another approach which should be considered in SA settings. It is important to note that these proposed approaches to decentralizing the management of complex GC cases are in keeping with the philosophy which underpins the SA National Health Insurance[31].

This study had several strengths. The first strength is that this study involved a large sample size, which reduced the risk of type II statistical error. Secondly, this study involved data over an 11-year period, which accounts for seasonal variation. Lastly, this is one of the first studies to conduct a geospatial analysis of GC in a SA setting. However, this study also had several limitations. Firstly, all data were from a single, quaternary hospital. In addition, this study only involved data from a public healthcare facility and trends in GC-related out-patient visits in the private healthcare sector were not investigated. This somewhat limits the generalizability of the study findings. There is also a possibility that some GC-related out-patient visits were incorrectly coded on the hospital's administrative database. Any procedures or treatments delivered during the outpatient visit could not be established from the hospital administrative database. With regard to the geospatial analysis, it is possible that some patients from far off places had given a local address in Durban where they would be staying while attending the clinic, when in fact their homes are not located in Durban. Another potential limitation related to the geospatial analysis is that some patients who had initially attended IALCH from the midlands region might have been subsequently referred to the closer, step-down tertiary-level Greys Hospital in Pietermaritzburg for the remainder of their outpatient followup. Lastly, healthcare expenditure could also not be investigated as cost data are not present in the hospital administrative database. In lieu of these limitations, it is recommended that further research be conducted to confirm the findings of this study.

Conclusion

There has been an increasing trend in the number of outpatient visits for the management of complex GC in KZN, SA. There is a need for a strong health promotion response aimed at tackling GC in this setting. Several urban and peri-urban regions of KZN appear to have high, overlapping burdens of complex upper and lower GC. There are also some rural regions where the burden of complex upper GC is considerable. It is likely that addressing primary and secondary prevention in regions most severely affected by GC would contribute toward reducing the burden created by complex GC cases on outpatient clinic services at IALCH. In addition, these regions should be considered as sites where decentralisation of certain outpatient services for GC can be offered. This can also assist in reducing the burden placed by GC on out-patent services at the sole quaternary level hospital in KZN.

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