

Mobile cancer preventive and early detection clinic in Uganda: Working with local communities as partners towards bridging the cancer health disparity

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Abstract

Background As high-income countries experience over-diagnosis of cancer diseases, the low-income countries are characterized by under-diagnosis or no diagnosis of even the most prevalent cancers. The Comprehensive Community Cancer Program (CCCP) is a community health unit of the Uganda Cancer Institute (UCI) that coordinates and implements primary prevention of cancer and early detection in Uganda. CCCP provides cancer information and screening services at UCI, in rural communities through mobile outreaches, mass media cancer awareness and training health workers on cancer prevention and early detection. We explored the feasibility and benefit of conducting outreaches in partnership with local communities.

Methods We analyzed the quarterly UCI-CCCP cancer health education and screening output report data from July 2016 to June 2019 to compare UCI-hospital-based and community outreach cancer awareness and screening services.

Results From July 2016 to June 2019, we worked with 107 local partners and conducted 151 outreaches. Out of the total number of people who attended cancer health education sessions, 77.9% were reached through outreaches. Ninety-two (95%) cancer awareness TVs and radio talk-shows conducted were sponsored by local partners. Out of the total people screened; 63.0% cervical, 64.4% breast and 38.7% prostate screening clients were screened through outreaches. The screen-positive rates were higher in hospital-based screening except for Prostate screening; cervical, 8.8%, breast, 8.4% prostate, 7.1 than in outreaches; cervical, 3.2%, breast, 2.2%, prostate, 8.2%). Out of the screened positive clients who were eligible for pre-cancer treatment like cryotherapy for treatment of pre-cervical cancer lesions, thousands-folds monetary value and productive life saved relative to the market cost of cancer treatment and survival rate in Uganda. When the total number of clients screened for cervical, breast and prostate cancer are subjected to the incremental cost of specific screening, a greater portion (98.7%) of the outreach cost was absorbed through community partnership.

Conclusions Outreaching and working in collaboration with communities as partners help in cost-sharing and leverage for scarce resources to promote primary prevention and early detection of cancer. This contributes to bridging cancer health disparity in the population.

Background

Cancer health disparity, also termed cancer health inequities refers to differences in access to cancer care, including information, early detection, treatment modalities and cancer-related outcomes such as incidence, prevalence, mortality and other adverse cancer-related health conditions among specific groups [1]. This group differential could be based on geographical, ethnic and socio-economic status, gender, education, culture or any other disadvantaged population groups [1].

As the high-income countries are experiencing over-diagnosis of cancer diseases [2], the low-income countries are characterized by under-diagnosis or no diagnosis of even the most prevalent cancers. This could be attributed to the relatively higher-level cancer-related functional health literacy, better cancer screening program with a fairly balanced supply of health technologies in high-income countries compared to low-income countries [3–5].

The low-income countries also experience an inadequate number of multi-disciplinary cancer experts, including clinical oncologists ([6]). Cancer control programs are not usually the top priorities of the top-level policymakers and international funders compared to infectious diseases in low-income countries. The low-income status of many African countries exacerbates this complex situation with either one or no comprehensive cancer centre, opportunistic or health camp-based screening programs. Rural and socio-economically disadvantaged populations experience the worst difficulties in accessing cancer prevention and early detection services. Deliberate efforts are required to outreach such populations with affordable cancer preventive and early detection services.

Cancer Early Detection And Treatment Cost

Cancer is a costly group of diseases with complex varying screening, diagnostic and treatment modalities worldwide. For example, the screening, diagnostic, and treatment costs for the three commonest Cancers in Uganda; Cervical, Breast and Prostate cancers vary significantly even if they were of the same disease-stage.

The average cost of cervical cancer screening using Pap smear is 91Euro in high-income countries [7]. The individual patient-level clinical cost per patient including diagnostic test, staging, treatment based on the FIGO stage I-IV cancer, chemotherapy and outpatient care increases with the stage of cancer disease. The average cost in high-income settings varies by stages for example in Europe; 17 514 euro (18,000USD) for FIGO Ia1-Ib1, 43 950 for FIGO Ib2, 45 126 for FIGO II, 41 125 for FIGO III and 51 420 for FIGO IV [7]. This amounts to an average cost of 33,189.17 Euro, equivalent of US \$36,751.07.

In East Africa, the cost of cervical cancer management in tax-payers publicly funded cancer hospitals also vary by disease sage, but much lower than the cost in high-income countries. For instance, in Tanzania, the average hospital-based screening cost based on visual inspection with acetic acid (VIA) per patient is US\$1.45, the average cost of cryotherapy for treating cervical-precancer lesions per patient is US\$28.97 whereas the

average cost of treating an early stage (stages 1 and 2) patient is US \$3000 [8]. In Ghana [9], the incremental economic costs per client screened with VIA varied from 4.93US\$ to 14.75 US\$, whereas the cost of cryotherapy varied from 47.26 US\$ to 84.48 US\$ whereas in base-case assumptions modelling, the costs of VIA was found to be 6.12 US\$ per woman and cost of cryotherapy found to be 27.96 US\$.

In the Medicare scheme in the United States, it is reported that the age-standardized breast screening-related cost per woman varied across regions from \$42 to \$107 [10]. The average market cost of early-disease breast cancer surgery; lumpectomy or mastectomy in Uganda as at 2018 was 10,500,000 Uganda shillings (US\$ 3000). A systematic review on Global treatment costs of breast cancer on FIGO staging system [11], the average cumulative treatment costs weighted by sample sizes were \$29,724 at stage I, \$39,322 at stage II, \$57,827 at stage III, and \$62,108 at stage IV in 2015 US dollars. On average, costs at stage II, III and IV were found to be 32%, 95%, and 109% higher than treatment costs at stage I. In other studies, in which invasive breast cancer was categorized as local, regional and distant, the average weighted costs were \$63,664, \$89,898 and \$168,906. Treatment costs of regional and distant breast cancer were found to be 41% and 165% higher than localized breast cancer on average [11].

In a study by Fourcade et al [12], Prostate cancer treatment cost per patient for localized disease excluding follow-up and adverse event cost varies by countries; 5851 Euro per patient in France, 3698 Euro per patient in Germany, 3682 Euro per patient in UK and 10,296 Euro in Canada, an average of 5,881 Euro (6369 US\$) per patient. Patients with regional prostate cancer experience higher total cost per patient to the average tune of 16,608 euro, an equivalent of 18,000 US\$ [13, 14]. Prostate cancer surgery on average cost 10,000 US\$ per patient (Pate et al. 2013). The average market cost of early-disease prostate surgery in Uganda as in 2018 was 15,000,000 Uganda shillings (US \$ 4,286). The average market cost of prostate screening using PSA, DRE with or without ultrasound scan in Uganda as in 2018 was estimated at 105,000 Uganda shillings (US\$ 30)

Cancer Control In Uganda

Since 1967, Uganda has one comprehensive cancer treatment centre, the Uganda Cancer Institute, located in the Central region of Uganda, within the Capital city, Kampala. However, there is a plan for the establishment of four regional cancer centres in Western, North-Western (West-Nile), Northern and Eastern Uganda. The integration of cancer information, screening and referral of suspected cancer cases in primary health-care facilities was initiated in 2017 through training of primary health-care workers. This is envisaged to contribute to increasing population cancer awareness to promote prevention and early detection.

In 2009 the concept of community cancer program came to reality when the Uganda Cancer Institute (UCI) received a donation of a 35-foot mobile mammography unit van from Yale University / Johnson & Johnson program. The purpose of this mammography-van that was one of the Yale-New Haven Hospital's mammography vans was for community breast cancer education and screening services. This was Under the auspices of Yale University School of Medicine's Johnson & Johnson supported 'Health Overseas Partnerships in Health and Education' (HOPE) program of 2008.

In 2015, with additional staff, the UCI-Community cancer unit, established daily cancer information and early detection services at UCI and routine community cancer outreaches. In 2018, Uganda Cancer Institute received another mammography-van donated by the Honorary Consul of Uganda in Mumbai, India, Madhusudan Agrawal, the Samta Foundation and Tata Group. The new mobile van is equipped with a mammography unit for breast cancer screening and space for cervical cancer screening.

The Community Program also called the Comprehensive Community Cancer Program (CCCP) is a community health section of the Uganda Cancer Institute (UCI) that takes lead in the primary prevention of cancer and early detection. The goal of CCCP is to reduce cancer risk by increasing access to and utilization of cancer prevention services. This is done through mass media cancer awareness, outreach and hospital-based health education on cancer risk factors, prevention, early detection measures and screening for the leading cancers; cervical, breast and prostate cancer. However, with inadequate program funding, it is unlikely to increasing access to primary prevention and early detection of cancer if the community resources are not tapped to add on the allocated Government funding.

In outreach model, the minimum staffing is composed of a team of at least 6 staff; 2 nurses, 1 doctor or gynaecologist, 1 health educator, one counsellor and a driver is required to provide quality cervical screening services to an average of 32 women per day. If Breast screening is added, then, 2 radiographers, 1 biomedical technician and 1 driver are added on the staff list. Where Prostate screening is on the agenda, then at least 1 lab technician and 1 additional doctor (Medical officer) is added on the list. This number is prorated based on the number, sex and age group of people expected to turn up for the services. This adds an additional cost of transport and staff facilitation of about 700,000 Ugandan shillings (US \$200), spread over 32 screening clients is an average of US\$ 6.25 as the unit screening cost. When the costing criteria used in Tanzania by Nelson et al. [8], then the unit cost for cervical screening using Visual inspection with acetic acid (VIA) as an example is US\$ 1.45 plus the staff facilitation cost of US\$ 6.25 totals to 7.7 US\$ per screening client.

In this report, despite limited funding for primary prevention and early detection of cancer in Uganda, we share how working with local communities as partners to leverage resources for increasing access to primary prevention and early detection of cancer in Uganda is feasible. Community organizations and partnerships are pivotal components of Community empowerment continuum [15] The ability of the community to mobilize resources both from its assets (within) and externally from beyond itself is an important factor in health promotion efforts [16]. This is a translation of the Asset-based community development model (ABCD) developed by John McKnight and John Kretzmann [17], used to discover a community's

capacities and assets and to mobilize those assets for community health improvement. This focuses on the strengths of a specific community and figuring how to bring those strengths to bear for the benefit of the community.

Through the Uganda Cancer Institute community cancer program, this approach is increasing access to cancer preventive services in rural communities and saving the would-be catastrophic expense on cancer disease management or the undesirable avoidable premature death. This is a way of working towards sustainability and community empowerment in resource-limited setting. We aimed to examine the contribution of working with community organizations to increase access to cancer prevention and early detection services in the community.

Methods

We analyzed the quarterly UCI-CCCP cancer health education and screening output report data from July 2016 to June 2019 to compare UCI-hospital-based and outreach cancer awareness and screening services. We also sought to provide insight into the benefit and feasibility of conducting community outreaches in community health centres, places of worships, schools and workplaces in partnership with local communities and non-health institutions. For clarity, community health centres, faith-based institutions, community-based organizations (CBOs), community political leaders and workplace managers were the key community-based institutions and structures through which we provided cancer primary prevention and early detection services to the communities.

In outreaches, the community partners mobilized the community, arranged for venues and other logistics including mass media (TVs and radio) airtime. UCI provided logistics and human resources to provide outreach services. We used mobile mammography van equipped with mammography and doctor /nurse space for clinical breast exam and mammography, with or without a recommendation for breast ultrasound and space for cervical screening. We used the digital rectal exam and PSA rapid tests combined with clinical criteria for prostate screening. Other cancer suspicious presentations and were clinically examined and referred for further investigation at UCI.

In cost comparison, the average unit cost for cancer screening was based on economic evaluation of cancer care done in various countries, notably; Cervical screening; Quentin et al. [9], Cervical pre-cancer treatment; Quentin et al. [9], Breast screening, Gross et al. [10]. The average unit cost for managing early-stage and late-stage cancer management was based on; Cervical; [7]Ostensson et al. (2015), Breast; Sun et al. [11], Prostate cancer; localized, Fourcade et al [12] and regional, De Oliveira et al. [13, 14]. The administrative overheads and procurement process related costs were not included in these considerations.

Results

The contribution of working with communities as partners to leverage health resources

From July 2016 to June 2019, we worked with 107 local partners either once or more than once to conduct 151 outreaches to extend cancer awareness and screening services in rural hard to reach and live populations in Uganda (Table 1). Out of the total number of people health-educated in group sessions and one-on-one on primary prevention of cancer, early detection and cancer management, 77.9% were reached through outreaches (Figure 1 & Table 1). Ninety-two (95%) cancer awareness TVs and radio talk-shows conducted were sponsored by local partners. Out of the total people screened; 63.0% cervical, 64.4% breast and 38.7% prostate screening clients benefited from outreaches (Figure 2). The screen-positive rates were higher in hospital-based screening except for Prostate screening; cervical, 8.8%, breast, 8.4% prostate, 7.1 than in outreaches; cervical, 3.2%, breast, 2.2%, prostate, 8.2% (Table 2 and Table 3).

Comparing the unit costs for screening, pre-cancer treatment, managing localized and advanced cancer diseases

The unit cost incurred in Cancer screening is thousands-folds less than the unit cost of managing in any stage of cancer disease (Table 4). The cost of managing cancer disease increases with the stage of cancer progression. Regarding Cervical cancer; the average unit cost for managing localized Cervical cancer cases is 2941 times (18,000 / 6.12) higher than the average unit cost of cervical screening. The average unit cost for managing advanced cervical cancer (Regional or distant) is 6005 times (36,751.07 / 6.12) higher than the average unit cost of screening. The average unit cost for managing advanced Cervical cancer (Regional or distant) is 1314 times (36,751.07 / 27.96) higher than the average unit cost of pre-cancer treatment of Cervical lesions using cryotherapy. The average unit cost of managing advanced Cervical cancer cases is two-folds (36,751.07 / 18,000) higher the unit cost for managing localized Cervical cancer cases.

In Breast cancer scenario; the average unit cost for managing localized Breast cancer cases is 708 times (29,724 / 42) higher than the average unit cost of screening. The average unit cost for managing advanced Breast cancer (Regional or distant) is 1479 times (62,108 / 42) higher than the average unit cost of breast screening. The average unit cost for managing advanced Breast cancer is 21 times (62,108 / 3000) higher than the average unit cost of pre-cancer treatment of Breast cancer lesions using Lumpectomy. The average unit cost for managing advanced Breast cancer (Regional or distant) is two times (62,108 / 29,724) times higher than the average unit cost for managing localized cervical cancer cases.

In the context of prostate cancer; the average unit cost for managing localized Prostate cancer cases is 212 times (6,369 / 30) higher than the average unit cost of screening. The average unit cost for managing advanced Prostate cancer (Regional or distant) is 600 times (18,000 / 30)

higher than the average unit cost of screening. The average unit cost for managing advanced Prostate cancer (Regional or distant) is 4.2 times (18,000 / 4,286) higher than the average unit cost of pre-cancer treatment of Prostate lesions using surgical intervention. The average unit cost for managing advanced Prostate cancer (Regional or distant) is 2.8 times (18,000 / 6,369) higher than the average unit cost for managing localized cervical cancer cases.

Table 1: Number of community partners, outreaches and health education sessions, 2016/17-2018/19, Uganda

Year	Number of community partners	Number of outreaches	Community sponsored TV & radio talks/interview	Govt sponsored TV & radio talks/interviews)	Total health educated	Health educated in outreach			Health educated at UCI		
						M	F	T	M	F	T
/19	42	61	22	1	143,436	30,289	87,563	117,852	5,461	20,123	25,584
/18	34	53	44	2	64,488	16,847	34,737	51,584	3,387	9,517	1,2904
/17	31	37	26	2	50,838	6,846	25,286	32,132	3,106	15,600	18,706
Total	107	151	92	5	258,762	53,982	147,586	201,568	11,954	45,240	57,194

Table 2: Comparing results of outreaches and UCI hospital-based screening: Screened positive and cancer suspicious rates, 2016/17-2018/19, Uganda

Total screened in both outreaches & UCI	Cervical screening based on VIA or Pap-smear					
	In outreaches with community support			UCI-Hospital based screening clinics		
	Screened (% of total screened)	Positive (%)	Suspicious for cancer (%)	Screened (% of total screened)	Positive (%)	Suspicious for cancer (%)
16,666	11432(67%)	457(3.9%)	387(3.4%)	5234(33%)	271(5.2%)	988(18.9%)
14,173	9059(64%)	161(1.7%)	179(2.0%)	5114(36%)	615(12.0%)	1128(22.0%)
5,490	2304(42%)	115(4.9%)	188(8.2%)	3186(58%)	309(9.7%)	516(16.2%)
36,329	22795(63%)	733(3.2%)	754(3.3%)	13534(37%)	1195(8.8%)	2632(19.4%)
Screening bases on CBE or mammography with or without breast ultrasound scan						
No. screened	In outreaches with community support			At UCI		
16186	11067(68.4%)	231(2.1%)	221(1.9%)	5119(31.6%)	418(8.2%)	317(6.2%)
11,774	8933(75.9%)	164(1.8)	216(2.4%)	2841(24.1%)	313(11.0%)	179(6.3%)
6233	2014(32.3%)	91(4.5%)	134(6.6%)	4219(67.7)	296(7.0%)	194(4.6%)
34193	22014(64.4%)	486(2.2%)	571(2.6%)	12179(35.6%)	1027(8.4%)	690(5.7%)
Screening based on DRE & PSA						
Number screened	In outreaches with community support			UCI-Hospital based screening clinics		
8,801	3143(35.7%)	215(6.85)	97(3.1%)	5658(64.3%)	186(3.3%)	274(4.8%)
1,692	856(50.6%)	107(12.5%)	95(11.1)	836(49.4%)	249(29.7%)	216(25.8%)
2172	905(41.6%)	82(9.1%)	141(15.5)	1267(58.4%)	114(8.9%)	191(15.1%)
12,665	4904(38.7%)	404(8.2%)	333(6.8%)	7761(61.3%)	549(7.1)	681(8.8%)

Table 3: Kaposi Sarcoma suspicious lesions based on clinical assessment, 2016/17-2018/19, Uganda

No. screened	Outreach in partnership with local communities						UCI-Hospital based screening clinics					
	Clinical assessment			Suspicious for further investigation			Clinical assessment			Suspicious for further investigation		
	T	M	F	T	M	F	T	M	F	T	M	F
1,619	725 (44.8%)	341	384	101 (13.9%)	48 (47.5%)	53 (52.5%)	894 (55.2%)	367	527	172 (19.2%)	91 (53.0%)	81 (47.0%)
1,185	523 (44.1%)	317	206	66 (12.6%)	39 (59.0%)	27 (41.0%)	662 (55.9%)	373	289	136 (20.5%)	82 (60.0%)	54 (40.0%)
1,269	415 (32.7%)	201	214	45 (10.8%)	26 (57.7%)	19 (42.3%)	856 (67.3%)	359	497	72 (8.4%)	39 (54.2%)	33 (45.8%)
4,073	1663 (41.0%)	859	804	212 (12.7%)	113 (53.3%)	99 (46.7%)	2412 (59.0%)	1099	1313	380 (15.8%)	212 (55.8%)	168 (44.2%)

Table 4: Comparing the unit costs for screening, pre-cancer treatment, managing localized and advanced cancer diseases

No. Screened (a)	Average unit cost of screening per client US\$ (b)	Average direct screening total cost incurred US\$ (c)	No. of pre-cancers/ screen positives (d)	Average unit cost of treating pre-cancer US\$ (e)	Cost incurred in treating pre-cancers US\$ (f)	Total cost of screening US\$ (g) =c+f	Suspicious cancer lesions (i)	Est.Min. No. that would be detected with cancer(j) d+i	Early stage cancer =20% of j	Late stage cancer = 80% of j	Est.Unit cost for localized cancer mgt	The would be cost incurred in managing localized cancer US\$ (k)	Est. Unit cost for managing advanced cancer (Regional or distant) US\$ (l)	The would be cost incurred in managing regional & distant cancer US\$ (m)	The would-be total cost of managing cancer disease
36,329	6.12*	2,223,334	1928	27.96*	53,907	2,277,241	3386	5,314	1,063	4251	18,000*	19,134,000	36,751.07*	156,228,799	175,362,799
34193	42*	1,436,106	1513	3000*	4,539,000	5,975,106	1261	2774	555	2219	29,724*	16,496,820	62,108*	137,817,652	154,314,472
12,665	30*	379,950	953	4,286*	4,084,558	4,464,508	1014	1,967	393	1574	6,369*	2,503,017	18,000*	28,332,000	30,835,017
83,187		4,039,390	4394		8,677,465	12,716,855	5,661	10,055	2,011	8,044	54,093	38,133,837		322,378,451	360,512,288

* The average unit cost for Cancer screening were based on; cervical screening Quentin et al (2011), Cervical pre-cancer treatment, Quentin et al (2011), breast screening, Gross et al. (2013) while Prostate screening was based on average market cost.

*The average unit cost for managing early stage and late stage cancer management were based on; Cervical, Ostensson et al. [7], Breast, Sun et al. [11] and Prostate cancer; localized prostate cancer, Fourcade et al [12]; regional prostate cancer, De Oliveira et al. [13, 14].

Discussion

The contribution of working with communities as partners to leverage health resources

In this report, we demonstrated the benefit and feasibility of working with communities as local partners especially in primary prevention and early detection of cancer. In communities, places such as community health centres, schools, places of worships and workplaces are organized avenues for partnership and leverage for the community. Community primary health-care facilities, Faith-based institutions, community-based organizations (CBOs), community political leaders and workplace managers are resourceful community-based institutions and structures through which cancer primary prevention and early detection services to the communities.

In regard to cancer awareness efforts through health education and use of mass media channels on primary prevention of cancer, early detection and cancer management, more people were reached through community partnership. For instance; 77.9% of people were health- educated through outreaches and ninety-two (95%) cancer awareness TVs and radio talk-shows were sponsored by local community partners.

Pertaining to cancer screening, overall, more people were screened in outreaches except for prostate screening; 63.0% cervical, 64.4% breast and 38.7% prostate screening. This is probably due to long-distance and associated cost involved in travelling to a tertiary hospital for cancer information and screening services. Therefore, bringing services closer to the people especially those in rural hard to reach and hard to live areas is an opportunity for the community members.

It was also observed that the screen-positive rate and cancer suspicious rate were higher in hospital-based screening than in outreaches. This could be so because some people might choose to visit the hospital only when they evaluate themselves to be most at risk or are driven by early warning signs and symptoms. Therefore, cancer awareness and screening outreaches, especially in rural areas, could significantly contribute to cancer risk reduction and early detection.

From the annual UCI workplan and budget, the average annualized budget for Cancer Outreach Service during 2016/17, 2017/18 and 2018/19 was 188,775,000 Uganda shillings (54,000 USD), equivalent to 162,000 USD spread over the three financial years. This excludes the costs of training health workers and developing cancer information, education and communication materials that were funded through the African development bank 'East Africa Centre of Excellence for Oncology project' at the Uganda Cancer Institute. When human resource cost like salaries except for outreach staff facilitation allowances is not considered, the 162,000 USD cancer outreach budget for the three financial years is only 1.3% of the total 12,716,855USD estimated cost of cancer screening during the three years period. Meaning that greatest portion (98.7%) of the outreach cost was absorbed by through community partnership. This portion of 98.7% was covered by the monetary and non-monetary community assets like arrangement of venues, local community health facilities and social mobilization among others. The UCI contribution was used in screening supplies and staff allowances.

A well-organized outreach model could bridge the cancer health-equity disparity especially for the rural residents and socio-economically disadvantaged individuals. Countries like South Africa, Nigeria, Canada and the USA used mobile cancer-preventive outreaches to increase access to primary prevention and early detection services [18, 19] [20].

These illustrate the benefit of working in collaboration with communities as partners and outreaching the rural population. Most importantly is the cost-sharing, leverage for scarce resources and increased capacity to sustain programs that promote primary prevention and early detection of cancer. Knowing the fact that low-income settings are characterized by inadequate investment in national cancer control, then the contribution of locally available community assets, whatever small it is, should not be ignored.

Unit costs for screening, pre-cancer treatment, managing localized and advanced cancer diseases

A snapshot into Costing cancer screening and treatment

The two common approaches applied in costing health-care services are; 'incremental' and 'base case' scenarios [21]. For simplicity, incremental economic costs involve two major steps; (1) the ingredients approach, that is quantities of resources used and (2) unit costs or prices are assigned to resources consumed [21, 22]. Alternatively, the 'Base-case scenario' is applied. In the 'Base-case scenario' the assumed resources used per client or patient is multiplied by their estimated unit costs and the influence of alternative assumptions for input parameters is tested through sensitivity analyses [21, 22]. The 'Base-case scenario' make assumptions for the costs of inputs, number of clients screened and treated by each service provider, effective working time of capital and staff, costs of training, duration of screening or patient management per client [21, 22].

Cervical cancer screening and treatment cost

In East Africa, it is reported that the cost of cervical cancer care in publicly funded cancer hospitals vary by cancer stage [8], however, it is lower than the cost of cancer care in high-income countries. For instance, in Tanzania, the average cost of hospital-based screening using visual inspection with acetic acid (VIA) per patient excluding human resource cost is US\$ 1.45 [8], the average cost of cryotherapy for treating cervical-precancer lesions per patient is US\$ 28.97 whereas the average cost of treating an early stage (stages 1 and 2) patient is US\$ 3000 [8]. This differs from the cost reported in Ghana by Quentin et al.[9] where the incremental economic costs per client screened with VIA varied from 4.93 US\$ to 14.75 US\$, whereas the cost of cryotherapy varied from 47.26 US\$ to 84.48 US\$ [9]. In the same study the 'base-case' assumptions modelling, the cost of VIA was found to be 6.12 US\$ per woman and cost of cryotherapy was found to be 27.96 US\$. In publicly funded hospitals in Tanzania, early-stage cervical cancer disease (stages 1 and 2) cost average of US\$ 1740 per patient [8]. This is because early-stage cervical cancer patients receive curative therapy; radiotherapy and chemotherapy that cost US\$ 1547.48 and US\$ 316.53, respectively, whereas late-stage cervical cancer patients receive only palliative radiotherapy at an average cost of US\$ 773.52 [8]. If the costs of human resources and treatment facilities are accounted for, this cost would be higher as observed in other parts of the world.

The average cost of cervical cancer screening using Pap smear was found to average at 91Euro in high-income countries [7]. The individual patient-level clinical cost per patient including cancer diagnostic tests, cancer staging, treatment based on the FIGO stage I-IV, chemotherapy and outpatient care increases with the stage of cancer disease. The average cost in high-income settings varies by stages for example in Europe; 17 514 Euro (18,000USD) for FIGO Ia1-Ib1, 43 950 for FIGO Ib2, 45 126 for FIGO II, 41 125 for FIGO III and 51 420 for FIGO IV [7]. This amounts to an average cost of 33,189.17 Euro, equivalent of US \$36,751.07 per cervical cancer patient.

Breast cancer screening and treatment cost

Women with breast cancer in sub-Saharan Africa (SSA) are younger compared with the western countries (Black and Richmond 2019). Majority of breast cancer patients present with advanced cancer when treatment options are limited and characterized by poor prognoses. Some of the reasons for late presentation could be lack of access to early detection services and practices such as mammography and breast examination. In the Medicare scheme in the United States, the age-standardized breast screening-related cost per woman varied across regions from \$42 to \$107 [10]. The average market cost of early-disease breast cancer surgery; lumpectomy or mastectomy in Uganda as at 2018 was 10,500,000 Uganda shillings (US\$ 3000).

In a systematic review of Global treatment costs of breast cancer by stage based on FIGO staging system [11], the average cumulative treatment costs weighted by sample sizes were \$29,724 at stage I, \$39,322 at stage II, \$57,827 at stage III, and \$62,108 at stage IV in 2015 US dollars. On average, the costs at stage II, III and IV were 32%, 95%, and 109% higher than the cost at stage I [11]. In the other studies where invasive breast cancer was categorized as local, regional and distant, the average costs weighted by sample sizes were \$63,664, \$89,898 and \$168,906 [11]. The costs of managing regional and distant breast cancer were 41% and 165% higher than that of localized breast cancer [11]. These costs are quite high for individuals of low-income countries like Uganda. Therefore, investing and tapping local community assets to focus on primary prevention or early detection when cancer could be managed and better-quality life is guaranteed are crucial options.

Prostate cancer screening and treatment cost

In a study by Fourcade et al [12] on prostate cancer treatment cost per patient for localized disease in European and American countries excluding follow-up and adverse events cost varies by countries; 5851 Euro per patient in France, 3698 Euro per patient in Germany, 3682 Euro per patient in UK and 10, 296 Euro in Canada, an average of 5,881 euro (6369 USD) per patient. Another study observed that patients with regional prostate cancer experience higher total cost per patient to the average tune of 16, 608 euro, an equivalent of 18,000 USD [13, 14]. Prostate cancer surgery on average cost 10,000 USD per patient (Pate et al. 2013). The average market cost of early -disease prostate surgery in Uganda as of 2018 was 15,000,000 Uganda shillings (US\$ 4,286). The average market cost of prostate screening using PSA, DRE with or without ultrasound scan in Uganda as of 2018 was estimated at 105,000 Uganda shillings (US\$ 30).

Comparing the unit costs for screening, pre-cancer treatment, managing localized and advanced cancer diseases

Cancer is a costly group of diseases with complex varying screening, diagnostic and treatment modalities worldwide. For example, the screening, diagnostic, and treatment costs for the three commonest Cancers in Uganda; Cervical, Breast and Prostate cancers vary significantly even if they

were of the same disease-stage. It is a common concern among cancer experts in high-income countries about over-diagnosis of cancer [2], while low-income countries are characterized by under-diagnosis or no diagnosis of even the most prevalent cancers. This is usually attributed to; better cancer screening program with a fairly balanced supply of health technologies in high-income countries compared to low-income countries [3, 5].

The low-income status fixes many countries with inadequate number of multi-disciplinary cancer experts especially clinical oncologists [6] and limited early detection technology options [5]. With the high prevalence of infectious diseases like malaria, HIV/AIDS and Tuberculosis, Cancer control programs are not usually the top priorities of governments and international funders compared to infectious diseases in low-income countries. The low-income status of many African countries exacerbates this complex situation with either one or no comprehensive cancer centre, opportunistic or health camp-based screening programs. This leaves the majority (80%) of cancer patients with one option of battling cancer when it is advanced at a costly price while the majority who could not afford the cost languish with untold suffering or seek help from traditional and alternative medical practitioners such as herbalists and self-proclaimed spiritual healers.

When you look at the cost of cancer awareness with screening and cost of managing cancer disease, the unit cost incurred in cancer screening is thousands-folds less than the unit cost of managing in any stage of cancer disease. The cost of managing cancer disease increases with the stage of cancer progression [7]. For example, the average unit cost for managing localized Cervical cancer cases is 2,941 times higher than the average unit cost of cervical screening. The average unit cost for managing advanced cervical cancer (Regional or distant) is 6,005 times higher than the average unit cost of screening. The average unit cost for managing advanced Cervical cancer (Regional or distant) is 1,314 times higher than the average unit cost of pre-cancer treatment of Cervical lesions using cryotherapy. The average unit cost of managing advanced Cervical cancer cases is two-fold higher the unit cost for managing localized Cervical cancer cases. This means residents of low-income countries are likely to continue experiencing catastrophic expenditure for cancer treatment if no local options of community assets are tapped into primary prevention and early detection of cancer.

Similar catastrophic costs are observed in other types of cancer. For instance, the average unit cost for managing localized Breast cancer cases is 708 times higher than the average unit cost of screening. The average unit cost for managing advanced Breast cancer (Regional or distant) is 1479 times higher than the average unit cost of breast screening. The average unit cost for managing advanced Breast cancer is 21 times higher than the average unit cost of pre-cancer treatment of Breast cancer lesions using Lumpectomy. The average unit cost for managing advanced Breast cancer (Regional or distant) is two times higher than the average unit cost for managing localized cervical cancer cases. In the context of prostate cancer, the average unit cost for managing localized Prostate cancer cases is 212 times higher than the average unit cost of screening. The average unit cost for managing advanced Prostate cancer (Regional or distant) is 600 times higher than the average unit cost of screening. The average unit cost for managing advanced Prostate cancer (Regional or distant) is 4.2 times higher than the average unit cost of pre-cancer treatment of Prostate lesions using surgical intervention. The average unit cost for managing advanced Prostate cancer (Regional or distant) is 2.8 times higher than the average unit cost for managing localized cervical cancer cases.

Conclusion

Rural and socio-economically disadvantaged populations experience the worst difficulties in accessing cancer prevention and early detection services. Deliberate efforts are required to outreach such populations with affordable cancer preventive and early detection services. Working in collaboration with community institutions and organizations helps in cost-sharing, leverage for scarce resources, increased capacity to sustain programs and opportunity to build public concern and an ecological approach to bridging cancer health disparities. In absence of regional cancer centres and cancer information and screening units in primary health facilities, increasing population cancer awareness to promote prevention and early detection should leverage from local assets through an organized outreach model as an intermediate solution especially in-low income settings with inadequate investment in national cancer control.

Declarations

Ethics approval and consent to participate: Not applicable

Consent for publication: Not applicable.

Availability of data and material: All relevant data are within this report.

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Figures

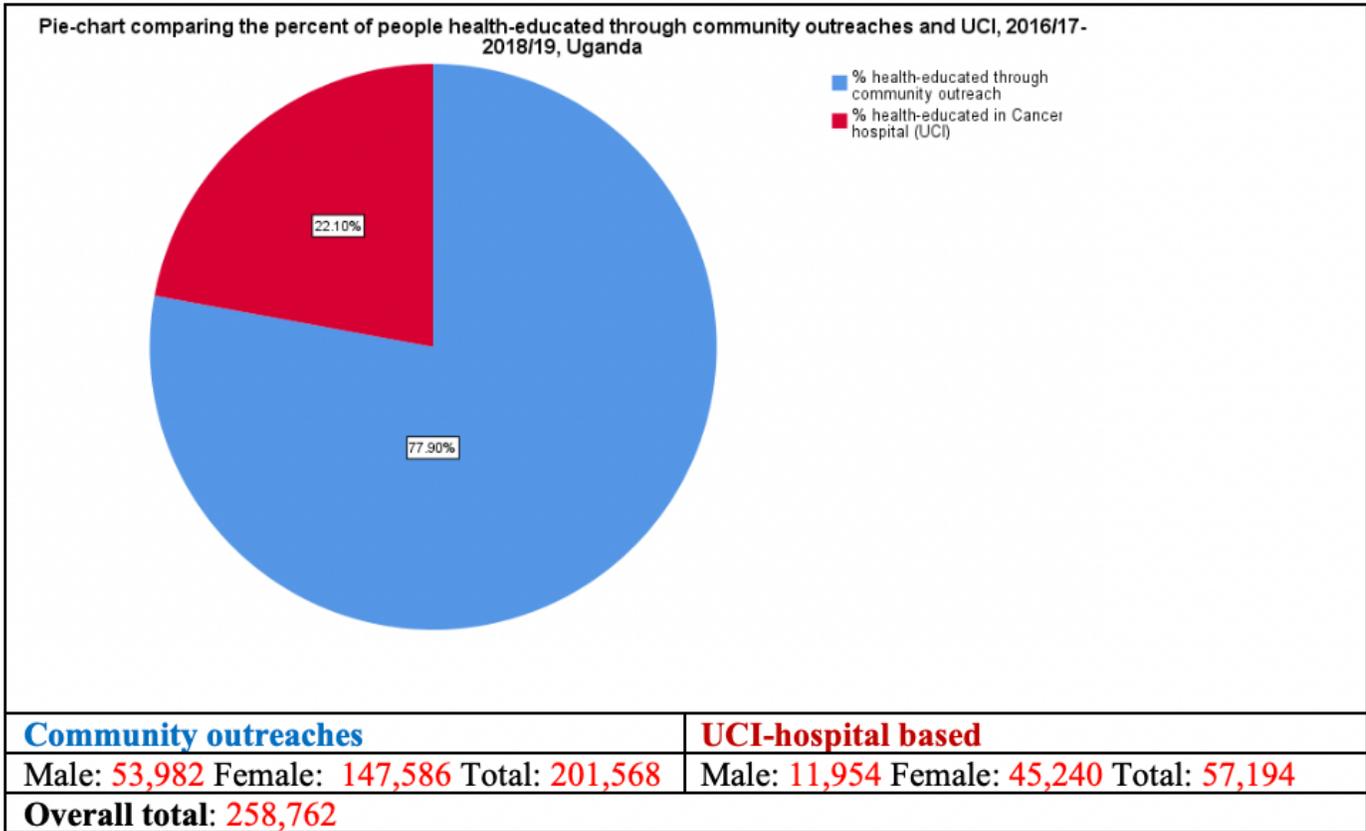


Figure 1

Proportion of people health-educated through community partnered outreaches and UCI Hospital-based sessions, 2016/17-2018/19

Percent of people screened during outreaches in partnership with communities versus UCI-Hospital based screening during 2016/17-2018/19

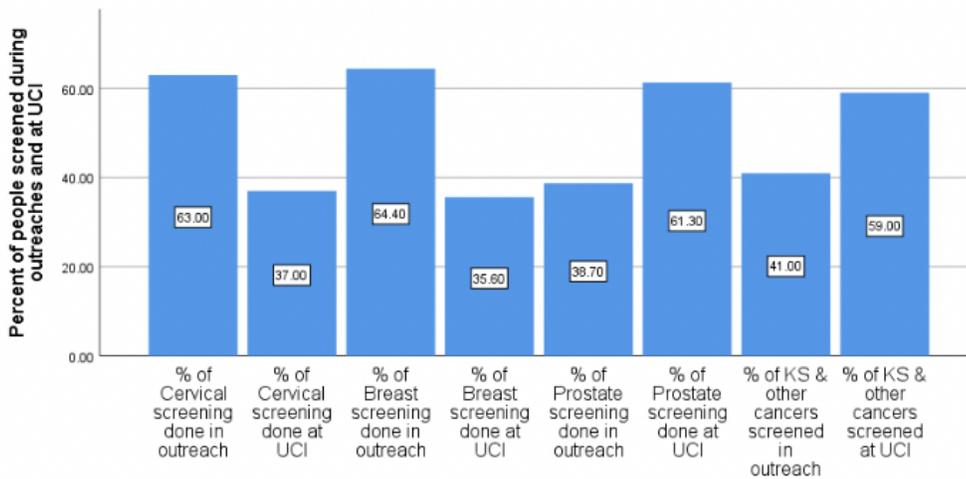


Figure 2

Proportion of people screened through community partnered outreaches and UCI Hospital-based screening clinics, 2016/17-2018/19