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Design and Implementation of a Cancer Screening Program for a Health District in Sub-Saharan Africa: A Pilot Study

Sylvester Adeh Nsoh[1], Paul Mobit[2, 3], Nicholas Ade[2, 3, *], Mc Che Joe Brown[4], Ambe Yancho[4], Isabella Fri Tayong[3]

[1]Department of Obstetrics and Gynaecology, Cameroon Oncology Center, Douala, Cameroon

[2]Department of Radiation Oncology, Cameroon Oncology Center, Douala, Cameroon

[3]Cameroon Cancer Foundation, Douala, Cameroon

[4]Department of General Medicine, Cameroon Oncology Center, Douala, Cameroon

Email address:

syladeh@yahoo.com (Sylvester Adeh Nsoh), mobit_paul@yahoo.ca (Paul Mobit), nickade00@yahoo.com (Nicholas Ade),
chejoebrown@yahoo.com (Mc Che Joe Brown), ambemaxwell@gmail.com (Ambe Yancho), fritayong00@gmail.com (Isabella Fri Tayong)
[*]Corresponding author

Abstract: The incidence of cancer in Sub-Saharan Africa is increasing and most cancers are diagnosed at advanced stages where treatment is usually less effective, more expensive, and more disabling. Early detection can reduce the burden of this health problem. This paper describes a pilot study to assess the feasibility of implementing a cancer screening program at the Dibombari Health District in Cameroon. A privately owned modern oncology center (Cameroon Oncology Center) located within the health district just outside the city of Douala in the Republic of Cameroon conducted the study. A total of 103 participants including 88 females and 15 males with a median age of 38 years (mean, 41.4 years; range, 17–82 completed years) were screened for cervical, breast and prostate cancers from October 24th to November 12th, 2021. Clinical examination of the breast and prostate for males, and breasts and genitals for females including visual inspections of the cervix with acetic acid then Lugol's iodine (VIA-VILI) were performed. Thirty-eight (representing 36.9%) of the screened participants had cancer suspicious lesions and accordingly received the following management plans: follow-up breast ultrasound (17 participants); follow-up pelvic ultrasound (7); follow-up microbiopsy (2); follow-up biopsy (1); follow-up Pap smear (9); and prostate-specific antigen test (4 males with enlarged prostate). The remaining 65 participants (63.1%) had no suspicious lesions, and were booked for a review in one year. Our study shows that most of the screened participants with suspicious lesions were asymptomatic. Our findings therefore highlight the feasibility of implementing a comprehensive cancer screening program in the health district given its effectiveness in lessening the burden of this health problem.

Keywords: Cameroon Oncology Center, Cancer Screening, Cervical, Breast, Prostate

1. Introduction

Resource-scarce countries like the Republic of Cameroon have a high incidence of cancer. Cameroon is a Sub-Saharan African country, (specifically in the central African sub-region) with an estimated population of about 29 million inhabitants. According to the International Agency for Research (IARC) on cancer employing data from GLOBOCAN (the Global Cancer Incidence, Mortality and Prevalence) database, about 20,745 people had cancer in Cameroon in 2020 with 13,199 deaths (about 64% deaths relative to incidence) [1, 2]. The figures show a cancer incidence and mortality rate of 71.5 per 100,000 and of 41.5 per 100,000 inhabitants, respectively. The relative incidence of cancer in Cameroon matches with that in Sub-Saharan Africa (SSA). As per GLOBOCAN 2020 data, SSA recorded about 801,000 new cancer cases in 2020 with approximately 520,000 deaths (nearly 65% deaths relative to incidence) [1–

3]. Globally, GLOBOCAN 2020 figures showed that 19.3 million people had cancer around the world in 2020 with 10 million deaths (51.8% deaths relative to incidence). The statistics thus show that the relative incidence of cancer is higher in SSA compared to the rest of the world. Moreover, it is projected that the global burden of cancer will rise sharply over the next decades, with the highest increases expected to occur in resource-scarce countries [1, 4]. These countries especially those in SSA are known to have weak health systems in which effective cancer services, and control programs are still a low priority and hence under-funded [5, 6]. Managing the anticipated heavy cancer burden in SSA would require huge investments in cancer control programs and therapeutic services.

Cameroon Oncology Center (COC) is a modern oncology center that was commissioned for clinical implementation in 2019 to contribute to efforts in dealing with the rising burden of cancer in SSA. COC is a profit neutral private oncology center located just outside the city of Douala in Cameroon. COC was founded with a mission to restore, maintain and improve health in a compassionate and professional environment using the state-of-the art technology. One of the approaches to contribute to this mission is the prevention, early diagnosis and effective management of cancer. Currently, COC treats cancer patients (using radiation therapy and chemotherapy) from all the ten Regions in Cameroon and the six neighbouring countries (Nigeria, Chad, Congo Brazzaville, Equatorial Guinea, The Central African Republic, and Gabon) as well as the Democratic Republic of Congo. Most of the cancer patients presented at COC come with advanced cases, which are more difficult and expensive to treat. This is a big problem in SSA as it is well-known that most cancers in SSA are diagnosed at advanced stages where treatment is usually less effective, more expensive, and more disabling. Early detection can be used to reduce the effects of cancer. It is the best alternative to the several cancers that cannot yet be prevented and to those that do occur even with prevention [6]. Moreover, it can significantly increase the likelihood of successful treatment [7]. Two different methods can be used for the early detection of cancer: early diagnosis for symptomatic disease, and screening of asymptomatic individuals in a target population [5].

Cancer screening is effective in reducing the burden of this global health challenge for a few selected cancer sites [8]. The most common cancer types vary among countries, and in Cameroon, breast (20.1%), cervical (13.4%), and prostate (10.6%) cancers are the most common [1]. Various methods for the screening of these cancers have been described in literature [9–13]. For instance, cervical cancer is the most widely screened cancer in the world [14]. It is one of the few preventable cancers if detected early [15]. Cervical cancer screening can include testing for human papillomavirus (HPV), visual assessment methods, and cytology, where available [12, 14, 16, 17]. Unlike mammography which is widely adopted in developed countries for the screening of breast cancer, in resource-limited settings, it is recommended that early detection be focused on down staging through

improved breast cancer awareness [18]. Breast self-examination and clinical breast examination are commonly adopted in low-resource settings through down staging [19]. The government of Cameroon already has a cancer-screening program for the common cancers but this program needs to be expanded and made more comprehensive.

This paper describes a pilot study carried out by COC to evaluate the feasibility of implementing a cancer screening program at the Dibombari Health District in Cameroon in order to contribute to government's efforts in managing the cancer burden. The Dibombari Health District is situated just outside the city of Douala where COC is located. The objectives of the screening were to: (1) differentially assess all participants aged 35 years or more for signs and symptoms of the common cancer types (cervical, breast and prostate cancers); (2) educate participants on self-examination and identification of signs and symptoms of the common cancers as well as immediate actions to undertake; (3) develop individual management plans for every screened participant; (4) sensitise and mobilise the community towards general medical care; and (5) educate the community about the services offered at COC.

2. Methodology

The health personnel at COC conducted the pilot study as a voluntary cancer screening campaign from 24th October, 2021 to 12th November, 2021. A total of 103 participants including 88 females (85.4%) and 15 males (14.6%) were screened for cervical, breast and prostate cancers. The total number of participants was low primarily because of inadequate sensitization which was effectively done only for a week. Programmed announcements in local churches could not be effected due to time constraints. It took long to obtain an authorization from the government for the exercise. There were nine sites for the screening exercise at the Dibombari Health District including daily sessions at COC, and one-day outreach session at each of the following eight sites within the Dibombari Health District: Catholic Church Bakoko, Presbyterian Church Yato, Baptist Church Yato, the Dibombari Health District Office, as well as the Bomono Babengue, Kapa, Bomono Gare, and Bikoko Health Centers. Each session began with educating participants on self-examination and the signs and symptoms of the cancers under review, followed by sensitization on the services offered by COC with special emphasis on cancer treatment and general medicine. Each participant was first received by our trained nursing staff who after educating the individual on the procedure including the benefits and possible discomforts, obtained their consent and vital signs. Gender specific education was offered on breast and cervical cancers for women, and breast and prostate cancers for men with a special focus on self-examination. The participant then proceeded to be attended by one of the medical doctors of the team who in turn consulted and examined the participant. The examination focused largely on the breasts and genitals for females, and the prostate for males. Lastly, visual

assessment of the cervix was done [12]. The assessment was done by examination of the cervix as it is (product-free visualization), followed by examination after application of acetic acid and later Lugol's iodine (visual inspection with acetic acid and then Lugol's iodine (VIA-VILI). Depending on the finding, a management plan was developed and discussed with the screened participant.

3. Characteristics of the Participants

3.1. Age Structure

The ages of the participants ranged from 17 to 82 completed years, with mean and median ages of 41.4 and 38 years, respectively. Splitting the participants into age groupings of 10 years showed that most (41.7%) of the participants were within the 31-40 years age group. This is in line with the young nature of the population. Three (2.9%) of the participants were below 21 years old.

3.2. Presenting Complaint

About one-half (50.4%) of the participants had no presenting complaint. Amongst the remaining 49.6% who presented some complaints, breast pain was in the lead with 11.4%. Other complaints with the proportion of complainants included breast lump (4.5%), general body pain (2.9%), body rash (1.9%), chest pain (1.9%), frequent urination (1.9%), bleeding between menses (1.9%), sexual weakness (0.9%), back pain (0.9%), vaginal itches (0.9%), and breast wound (0.9%).

3.3. Past Medical, Gynaecological and Obstetric History

3.3.1. Life Style and Chronic Medical Conditions
The past medical history of the participants revealed that a simple majority (53.4%) had breastfed or consumed alcohol (68.9%), and 33% had at least a family member living or once lived with cancer. Low down the line, 13% of the participants were known to have arterial hypertension while only 2.9% had a history of smoking or ever smoked.

On focusing on the 88 female participants various obstetrical and gynecological parameters were observed.

3.3.2. Gynecological Parameters
95.3% of the female participants recalled their ages at menarche. The ages at menarche varied between 11 (4.5%) and 18 (5.7%) completed years. Most of the women clustered between 12 and 16 years with 14 years being in the lead (23.8%), followed by 13 years with 19.3%, then 15 years (14.8%), 12 years (12.5%), 16 years (11.6%). The smallest cluster was 17 years with 2.3%. At the other extreme, 22.8% of the women were in menopause while the majority (77.2%) were still menstruating. This is a reflection of the young nature of the population. However, only 34.0% had used at least a method of artificial contraception.

3.3.3. Obstetric Parameters
15.9% declared not to have been pregnant. Amongst the

remaining 84.1% who had had at least one pregnancy, the declared number of pregnancies ranged from one representing 7.9% to 10 (1.1%). The frequently reported number of pregnancies was 4 declared by 19.3% of the women, followed by 5 (12.5%), 3 and 6 each representing 11.3%. The lead number of deliveries was 3 reported by 15.9% of the women whilst the lead number of abortions was one reported by 27.3% followed by two indicated by 14.8%. The highest number of deliveries per woman was 9 reported by 2 (2.2%) of the women. 21.6% (19) of the women had no living child. Among those who had living children, most of the women (78.5%) had between 1 and 5 living siblings with two peaks at 2 and 4 each contributing 14.8%. Physical examination was revealing in only 5.7% of the screening attendees with 3.9% of the males having an enlarged prostate, followed, for the females, by a cervical lesion and mastectomy scar each scoring 0.9%.

4. Results and Discussion

4.1. Screening for Breast Cancer

Of the 88 women examined, 14 (15.9%) complained of either having a breast pain (10) or self-declared having a breast lump (4), but on clinical examination, only one of the women actually had a breast lump. In addition to the lone woman four other women were found with breast lump though they did not complain. In all, 5 (5.7%) of the women objectively had a breast lump. Detail analysis of these cases has been withheld pending results of para-clinical examinations which we shall report in the future.

4.2. Screening for Cervical Cancer

VIA-VILI was interpreted as non-pathological (no pre-cancerous lesion) or pathological (suspicion of a pre-cancerous or cancerous lesion). Any whitish cervical lesion with distinct outline following the application of acetic acid and then Lugol's iodine was considered positive or pathological and styled VIA-VILI positive. Table 1 shows the distribution of the female participants according to VIA-VILI results. Amongst the 88 women who participated in the screening program, Table 1 shows that 84.1% had VIA-VILI negative results, 13.6% had suspicious results and 2.3% had positive results. This proportion of positive cases is correspondingly lower than the 6.5% reported by Tassang et al. [20] in Buea-Cameroon. Tassang et al studied 124 women as opposed to the 88 in the present study.

Table 1. *Distribution of female participants according to VIA/VILI results.*

Description	N	Percent (%)
Positive	2	2.3
Suspicious	12	13.6
Negative	74	84.1
Total	88	100

4.2.1. VIA-VILI Positive
The two women who ended up with VIA-VILI positive

results were aged 37 and 61 completed years, respectively making it reasonable to screen both young and old women. The younger of these women had menarche at 16 years of age, had normal blood pressure and complained of breast pain with a cervical lesion found on clinical examination. The older had menarche at 15 years, had an elevated blood pressure and complained of general body pain which is frequent at this age but no cervical lesion was clinically found. In comparison, positive cases found in the study conducted by Tassang et al. [20] were aged between 21 and 24 years. In a study on risk factors of cervical cancer, Shama and Pattanshetty [21] found ages at menarche of 13-14 years

to be a significant risk factor of cervical cancer. All of the positive cases in the present study had a family member who was living or once lived with cancer. As part of the management follow-up, all were booked for Pap smear amongst other para-clinical investigations. Table 2 shows the life style and obstetrical parameters of these women. Case 1 represents the older woman and case 2 the younger.

As reported by Shama and Pattanshetty [21], at least one abortion, and parity of ≥ 3 were found to be important risk factors in the development of cancer of the cervix. An increased risk for in situ cancer of the cervix was the case for parous women in a study conducted by Miller et al [22].

Table 2. *Distribution of VIA-VILI positive according to studied parameters.*

Category	Variable	VIA/VILI Positive Case 1	VIA/VILI Positive Case 2
	Number of gestations	7	3
	Number of deliveries	6	3
Obstetrical parameter	Number of abortions	1	0
	Number of living children	6	3
	Ever breastfed/breastfeeding	Yes	No
	Using/ever used contraceptive	No	No
Life style parameter	Ever drank/drinking alcohol	Yes	No
	Ever smoked/smoking cigarette	No	No

4.2.2. Participants with VIA-VILI Suspicious Lesions (N=12)

(i). Age Structure, Complaints and Findings on Physical Examination

The 12 participants who ended up with suspicious VIA-VILI lesions declared ages between 31 to 70 completed years with seven (58.3%) being between 31-40 completed years, followed by the 41-50 age group which contributed four

(33.3%) of the participants.

Eight (66.7%) of the women presented with no complaint. Of the remaining four who presented with any complaint, breast pain was evoked by two or 50% while vaginal itches plus rash and general body pain were each presented by one or 25% of these women. However, none of these women presented any finding on physical examination. Findings on other studied medical conditions of these participants are displayed in Table 3.

Table 3. *Distribution of female participants with VIA-VILI suspicious lesions according to some clinical parameters.*

Parameter	YES		NO	
	N	Percentage (%)	N	Percentage (%)
Known hypertensive patient	4	33.3	8	66.7
Ever drank alcohol	9	75	3	25
Ever smoked cigarettes	0	0	12	100
Family member living with or died of cancer	4	33.3	8	66.7
Ever breastfed or breastfeeding	7	58.3	5	41.7
Using or ever used contraceptive	4	33.4	8	66.7

(ii). Gynaecological Parameters of Women with Suspicious VIA-VILLI Results

Table 4. *Distribution of female participants found with VIA-VILI suspicious lesions according to age at menarche.*

Age at menarche (years)	N	Percentage (%)
12	2	16.7
13	1	8.3
14	6	50
15	2	16.7
16	1	8.3

A large majority (10 or 83.3%) of the women with suspicious cervical lesions on VIA-VILI were still

menstruating. Table 4 informs on the ages at menarche of these women. The table shows that 50% of the women had menarche at 14 years of age.

(iii). Obstetrical Parameters of Women with Suspicious Lesions on VIA-VILI

Table 5 shows the distribution of female participants found with VIA-VILI suspicious lesions according to their study's obstetrical parameters. The table shows that among the women with VIA-VILI suspicious lesions 66.6% of them have had 4 or 6 pregnancies, 41.7% had at least one abortion, and another 66.6% have had 4 or 5 deliveries.

Table 5. Distribution of female participants found with VIA-VILI suspicious lesions according to study's obstetrical parameters.

Number of gestations with proportion of women (N= 12)		
No of gestations	No of Women	Percent (%)
0	0	0
1	0	0
2	0	0
3	2	16.7
4	4	33.3
5	0	0
6	4	33.3
7	2	16.7

Parity with proportion of women (N=12)		
Parity	No of Women	Percent (%)
0	0	0
1	1	8.3
2	1	8.3
3	2	16.7
4	4	33.3
5	4	33.3
6	1	8.3
7	0	0

Number of abortions with proportion of women (N=12)		
No of abortions	No of Women	Percent (%)
0	3	25
1	5	41.7
2	4	33.3
3	0	0
4	0	0
5	0	0
6	0	0
7	0	0

4.2.3. Management Plan for Women with Suspicious Lesions on VIA-VILI

The distribution of female participants found with VIA-VILI suspicious lesions according to proposed management plan is shown in Table 6. The table shows that Pap smear (58.3%) was the lead follow-up para-clinical examination requested for women with VIA-VILI suspicious lesions.

Table 6. Distribution of female participants found with VIA-VILI positive/suspicious lesions according to proposed management plan.

Management plan	N	Percent (%)
Pelvic ultrasound scan (USS)	2	16.7
Pelvic USS + Microbiopsy	2	16.7
Pap smear	7	58.3
Biopsy	1	8.3

4.3. Male Participants with Clinically Enlarged Prostate

The four male participants who were found with a clinically enlarged prostrate were distributed one each in the age groups 41-50, 51-60, 61-70 and 71-80 years, respectively. All of them had a management plan that requested for the quantification of their prostate surface antigen (PSA). It was observed that none of the four presented with any complaint. Findings on other studied medical conditions of these participants are presented in the table below. As the table shows, two (50%) of the participants had raised blood pressures but were all known hypertensive patients. 75% were consuming alcohol. Interestingly none of the four men presented any complaint.

Table 7. Distribution of men with clinically enlarged prostrate according to studied parameters (N=4).

Parameter	YES		NO	
	No of participants	Percentage (%)	No of participants	Percentage (%)
Known hypertensive patient	2	50	2	50
Ever drank alcohol	3	75	1	25
Ever smoked cigarettes	1	25	3	75
Family member living with or dead of cancer	1	25	3	75

4.4. Management Strategies

Table 8 shows the distribution of all 103 screened participants according to proposed management plan. The table shows that 71 (68.9%) of the screened persons were booked for a review in one year. This is equal to the proportion that ended up with no suspicious lesion in the direction of the cancers screened for. Although four males were found with enlarged prostates and had a management plan that requested for PSA test, this test was requested for all the male participants regardless of clinical status of the prostate.

Cameroon Oncology Center currently operates Cameroon's only medical linear accelerator (linac) which is a modern radiation equipment for cancer radiation therapy (RT). The commissioning of the medical linac and its clinical implementation as well as the work flow of the RT services has been described elsewhere [23–25].

Table 8. Distribution of all screened persons according to proposed management plan.

Category	N	Percent (%)
Review in one year	65	63.1
Follow-up breast USS + mammography	17	16.5
Follow-up pelvic USS	7	6.8
Follow-up microbiopsy	2	1.9
Follow-up biopsy	1	1.0
Follow-up pap smear	7	6.8
PSA (prostate-specific antigen) test	4	3.9
Total	103	100

5. Conclusion

We conducted a pilot study to assess the feasibility of implementing a cancer screening program for a health district in a low-resource setting in Sub-Saharan Africa. Participants were screened for cervical, breast and prostate cancers, and

management plan was developed for each screened participant based on the findings. Most of the VIA-VILI positive and suspicious picked-up cases for cervical cancer screening were asymptomatic. So resource-limited settings such as those in Sub-Saharan Africa should focus on early cancer detection approaches such as comprehensive screening programs. The major challenge encountered in our study was the low number of participants that resulted from insufficient sensitisation. Therefore, in the future enough time should be allowed for sensitisation. This will evidently increase the number of persons who will benefit from the screening. The study thus highlights that it is feasible to implement a cancer screening program in our health district given its effectiveness in lessening the burden of this health crisis. It should be noted that studies such as the present study may be used by authorities and professional bodies to develop policies in the design of cancer control programs in low-resource settings in SSA.

Acknowledgements

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