Predictors of risk of financial hardship and coping with computed tomography utilization in Limbe, Cameroon: a sequential explanatory mixed-methods study.

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Abstract

Background Computed tomography (CT) is still fairly expensive in Cameroon and is mainly accessed through out-of-pocket (OOP) payments. Its introduction to peripheral health facilities in communities where many live below the poverty line and do not have financial risk protection is a laudable effort though current price listings suggest a mismatch with the purchasing power of potential users. Risk of financial hardship after CT use is an expected reality and we sought to determine predisposing factors and elaborate on how users adapt and cope.

Methods We carried out a sequential explanatory mixed methods study with a quantitative hospital-based survey of CT users followed by an in-depth interview of some purposively selected participants who reported risk of financial hardship after CT use. Data was summarized using frequencies, percentages and 95% confidence intervals. Logistic regression was used in multivariable analysis to determine predictors of risk of financial hardship. Themes emerging from the in-depth interviews were categorized. Quantitative and qualitative data were integrated.

Results A total of 372 participants were surveyed with a male to female sex ratio of 1:1.2. The mean age (standard deviation) was 52(17) years. CT scans of the head and facial bones accounted for 63% (95%CI: 59%-68%) and the top three indications were suspected stroke (27% [95%CI: 22%-32%]), trauma (14% [95%CI: 10%-18%]) and persistent headaches with blurred vision (14% [95%CI: 10%-18%]). Seventy-two percent (95%CI: 67%-76%) of respondents declared being at risk of financial hardship after CT use and predictors in the multivariable analysis were low socioeconomic status (aOR: 0.19 [95%CI: 0.10-0.38]; p<0.001) and not having any form of financial risk protection (aOR: 3.59 [95%CI: 1.31-9.85]; p=0.013). Coping strategies included relying on family members and friends for financial assistance, lobbying hospital administration, social services and
healthcare staff for a reduction of the direct cost, and borrowing of money.

Conclusion The risk of financial hardship is a real threat to CT utilization and some users resort to different practices to minimize the burden of OOP payments. Opportunities to improve CT affordability should be enhanced to reduce this burden and the negative consequences of the coping strategies.

Background

Socioeconomic status (SES) plays an important role in the use of healthcare services [1–3]. Persons with high SES have been reported to use more specialized healthcare services and to benefit from sophisticated medical procedures unlike individuals with low SES [2–4]. Consequently, better health and longer life are associated with a high SES whilst increased disease prevalence and mortality are reportedly associated with a low SES [1, 5–9]. The main reasons advanced are that individuals with high SES can afford the cost of healthcare services even when these are not covered by a medical insurance scheme and are also more likely to engage in a healthy lifestyle [10].

Computed tomography (CT) is a high-technology imaging modality with clinical applications ranging from trauma and stroke imaging to sophisticated angiographic and interventional procedures. It is a referral technology with significant exposure to ionizing radiation therefore requiring strong regulations to caution its use [11]. Regarding the relationship between SES and CT use, some published studies have reported a low likelihood for individuals with a low SES to use CT whilst a few reported the contrary or no association between CT use and SES [4, 12–16]. Whilst these studies were carried out in developed countries, there is very little published data from sub-Saharan Africa on CT use. One study has reported on the appropriateness of its use [17]. In many low-income countries the purchase of health services is through out-of-pocket (OOP) payments, that is, direct and immediate cash payments. With prevailing and widespread poverty it is
likely that a mismatch between the purchasing power of potential CT users and the cost of services might increase the risk of financial hardship after use.

Eradicating the risk of financial hardship or impoverishment as a result of the use of health services is key to the philosophy of universal health coverage [18]. Financial hardship or impoverishment capture the extent to which households’ pre-existing level of poverty worsens, or are being pushed below the poverty line as a result of OOP payments for health services [19]. Many low-income countries including Cameroon are still to successfully implement a sustainable scheme that financially protects the population from the effects of OOP payments for health services. Whilst such a scheme is eagerly awaited potential CT users will have to continue to find a balance between their financial capability and the cost of CT scans in health facilities where this technology is available. We therefore sought to investigate CT use at the Regional Hospital Limbe, an intermediate-level peripheral referral hospital in Cameroon where this technology has been recently introduced.

Context

Public health facilities in Cameroon are stratified into tertiary, intermediate and peripheral levels based on the degree of sophistication of available technology and health services offered. The tertiary facilities (teaching and national referral hospitals) which are the most equipped in terms of equipment and medical specialists are found in the two chief towns of Yaoundé and Douala. Intermediate-level health facilities are termed Regional and District Hospitals and they serve as reference hospitals within administrative regions. In a bid to improve access to healthcare the government of Cameroon is face-lifting intermediate-level health facilities by creating specialized units such as hemodialysis and medical imaging centers that were previously only available in tertiary health facilities. Many medical specialists are being deployed to these hospitals which have mostly had
general practitioners, obstetricians and general surgeons over the years. The direct cost of CT scan at Regional Hospital Limbe ranges from 50,000 XAF to 100,000 XAF. Using the public service as a guide, the basic salary in the Cameroonian public service as from July 7, 2014 ranges from 45,643 XAF to 294,147 XAF.

Quantitative research question:
What factors are associated with the risk of financial hardship after using CT?

Qualitative research question:
How do some user characteristics translate into risk of financial hardship after CT use?
How do CT users adapt and cope with having to use CT?

Mixed-methods research question:
How well does the qualitative phase augment the findings from the quantitative phase?

The information derived from this study can be useful in informing policies directed towards the improvement of access to CT in the study setting and in other places with similar socioeconomic attributes and policy.

Methods

Ethics

Administrative authorization for the study was given by the South West Regional Delegation for Public Health (R11/MINSANTE/SWR/RDPH/82/786) and ethical approval was obtained from the Institutional Ethics Committee of Regional Hospital Limbe (002-03/2018/IEC-RHL) and The University of Yaoundé 1 (108/UY1/FMSB/VDRC/CSD).

Study Setting

The study was carried out at Regional Hospital Limbe, a 200-bed capacity health facility with a medical imaging center that has been functional since November 2016. This center has a 16-slice computed tomography scan, digital radiography and mammography equipment and a modern ultrasound scanner. The hospital has a 24-hour emergency department, operation theatre, neonatology and pediatric units, antenatal clinic and
maternity, medical and surgical wards for admission, and medical specialists across the major specialties.

Study Design

We used a sequential explanatory mixed-methods design which consists of two distinct phases; quantitative data collection and analysis followed by qualitative data collection and analysis [20]. This paradigm has the potential to permit us study the role of some variables regarding CT utilization in breadth and depth and therefore augment the understanding developed from the study [21–23]. Furthermore, given that the findings of this study should have practical implications, this design is compatible with the philosophical stance of pragmatism and critical realism [20, 24, 25].

Participants

Quantitative phase

Consenting CT users 18 years old and above at the Medical Imaging Center of Regional Hospital Limbe were consecutively enrolled from March 2018 to February 2019. Written informed consent was obtained from the participants or their caregivers.

Qualitative phase

Some participants from the quantitative phase who did not have health insurance and who reported to be at risk of financial hardship after CT use were selected using a purposive random technique [26, 27].

Sample Size

Quantitative phase

The minimum sample size was estimated using Cochran’s method for surveys [28]. The risk of financial hardship after CT use was the primary outcome and expressed as a binary categorical variable. With an alpha level of 0.05, a 5% error margin, a population variance
estimate of 0.25, and a population of 1,614 CT users for the past 12 months before the study, the minimum return sample size was 310.

Qualitative phase

We invited 28 potential participants for in-depth interviews and 22 were actually interviewed. According to Morse and Guest’s suggestions of 6 participants when exploring experiences and 12 participants to obtain thematic saturation respectively [29, 30], this sample size was deemed satisfactory to explore the participants’ experiences on CT utilization.

Data Collection

Quantitative phase

Structured interviews with standardized forms were used to collect data. The main items were demographic attributes (age and sex), socialization patterns (region of origin, educational achievement; marital, employment and socioeconomic status; health insurance subscription), the presence of chronic illnesses, anatomic region scanned and clinical indication, payment method for CT and the risk of financial hardship after CT use. Socioeconomic status was assessed using household amenities score with each participant assigned to the quintile corresponding to their score. This tool has already been used in a previous study carried out in a similar setting [31]. The risk of financial hardship was determined using a self-reported question: “Do you have enough money to meet your needs including food, clothing, and payment of bills after paying for CT?” The options were “more than enough”, “just enough” and “less than enough” [32].

A trained research assistant with a degree in sociology and who is fluent in English, French and the local pidgin-English language collected all the data. The standardized forms were available in English and French. The items were interpreted into the local
pidgin-English language for participants who could best express themselves using that language. The data collector wore an identification badge and consenting participants were interviewed after CT had been done in an office made available for this purpose within the health facility. The principal investigator (PI) cross-checked all the forms after interviews for consistency.

Qualitative phase

The PI (JT) called up potential participants by phone to invite them for the interviews. Information shared during this first phone call included an overview of the talking points, the expected duration of the interview and subsequent appointment for a telephone interview at the convenience of the participant, should they consent to participate. A pre-established guide developed after quantitative data analysis (Box 1) was used for the interviews which were conducted by the PI in the preferred language of the participant. Whilst being open to a wide range of ideas during the interviews, the discussion was nevertheless kept in line with the study objectives. Permission to audio-tape the conversation was requested from the participants at the beginning of the interview.
Data analysis

Quantitative phase

Data were recorded electronically on a Microsoft Excel® spreadsheet and analyzed using STATA® 12 (StataCorp, Texas, USA). Continuous variables were summarized using the mean and standard deviation or median and interquartile range as appropriate. Categorical variables were summarized using frequencies, percentages and 95% confidence intervals (CI). The risk of financial hardship after CT use was categorized as a binary variable with the options “just enough” and “less than enough” merged into one category and representing “risk” of financial hardship, while the option “more than enough” represented “no risk” of financial hardship. Univariate and multivariable logistic regression techniques were used to determine if any factors were associated with the risk of financial hardship after CT use. In the multivariable modelling the following covariates were entered as a block: age, sex, marital status, educational achievement, employment

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Box 1. In-depth interview guide

- How often within the past twelve months have you had health problems for which CT was requested?
- How do you typically raise money to cater for your health needs?
- Describe how it was like raising the money and paying for this CT scan.
- What particular difficulties did you encounter and how did you go about them?
- How do you think some aspects of your current situation (such as family life, job situation, educational achievement, lack of health insurance, current income) affected the way you had to go about getting the scan done?
- How much time did it take for you to get the scan done from the day it was prescribed, and why so?
- How do you feel about catering for your basic needs for the days ahead?
- What, in your opinion, are the opportunities which if in place would make it easier for you to obtain CT or feel less financial stress after?
status, SES, health insurance ownership and the presence of chronic illnesses (binary variable). Statistical tests were two-tailed and p-values less than 0.05 were considered statistically significant. Model fit was assessed using $R^2$ statistic.

**Qualitative phase**

Each audio-recording was reviewed after each interview. Content analysis was used to identify themes that emerged from the interviews. Word repetitions and indigenous categories were used in the thematic analysis [33]. Themes were initially categorized and further explored in subsequent interviews. The audio-recordings were played many times over to exhaust all possible themes in the data, confront with initial categories/subcategories and analyze relationships between categories. To improve on credibility and trustworthiness two other investigators (GN and AE) independently reviewed the audio-recordings and identified themes. The final version of categorized themes was consensual.

**Data Integration**

The separately analyzed data from both strands of the study were integrated to gain a more complete understanding that is “greater than the sum of the parts” [22]. Triangulation was used for data integration as findings were compared and contrasted for convergence, complementarity and dissonance [34].

**Results**

**Participant characteristics**

A total of 372 participants were surveyed of which 167 (45%) were females. The mean age (standard deviation) was 52 (17) years with age range 18 to 92 years. Table 1 summarizes participant characteristics.
Table 1. Characteristics of study participants

| Variables                                      | Frequency (%) |
|-----------------------------------------------|---------------|
| **Sex (N = 372)**                             |               |
| Female                                        | 167 (44.9)    |
| Male                                          | 205 (55.1)    |
| **Marital status (N = 372)**                  |               |
| Married                                       | 232 (62.7)    |
| Single                                        | 83 (22.3)     |
| Widow(er)                                     | 42 (11.3)     |
| Divorced                                      | 11 (3.0)      |
| Living in union                               | 4 (1.1)       |
| **Educational achievement (N = 347)**         |               |
| <O level                                      | 158 (45.5)    |
| O level or equivalent                         | 61 (17.6)     |
| A level or equivalent                         | 64 (18.4)     |
| Degree or equivalent                          | 45 (13.0)     |
| Master & above                                | 19 (5.5)      |
| **Employment status (N = 294)**               |               |
| Employed, with contract                       | 82 (27.9)     |
| Employed, with no contract                    | 2 (0.7)       |
| Self-employed                                 | 115 (39.1)    |
| Unemployed                                    | 12 (4.1)      |
| Retired                                       | 83 (28.2)     |
| **Socioeconomic status quintiles (N = 370)**  |               |
| SES quintile 1                                | 74 (20.0)     |
| SES quintile 2                                | 75 (20.3)     |
| SES quintile 3                                | 75 (20.3)     |
| SES quintile 4                                | 79 (21.4)     |
| SES quintile 5                                | 67 (18.1)     |
| **Health insurance ownership (N = 370)**      |               |
| Yes                                           | 38 (10.3)     |
| No                                            | 332 (89.7)    |
| **Number of deponents (N = 272)**             |               |
| 0 to 3                                        | 117 (43.0)    |
| 4 to 6                                        | 97 (35.7)     |
| 7 and above                                   | 58 (21.4)     |
| **Presence of chronic illnesses (N = 369)**   |               |
| Yes*                                          | 130 (35.2)    |
| No                                            | 239 (64.8)    |

*: Included in this category are hypertension, diabetes, peptic ulcer disease, cancer, chronic kidney disease, hyperprolactinemia

Anatomic region scanned and clinical indications

CT scans of the head and facial bones accounted for 236 out of 372 scans (63% [95%CI: 59%-68%]) and the top three indications were suspected stroke, transient ischemic attack or hypertensive emergency (27% [95%CI: 22%-32%]), trauma (14% [95%CI: 10%-18%]) and persistent headaches, blurred vision or suspected space-occupying lesion (14% [95%CI: 10%-18%]). Table 2 summarizes the anatomic regions scanned.

Table 2. Anatomic regions scanned.

| Anatomic region scanned (N = 372) | Frequency (%; 95%CI) |
|----------------------------------|-----------------------|
| Head + facial bones              | 236 (63.4; 58.5-68.3) |
| Abdomen                          | 46 (12.4; 9.0-15.7)   |
| Spine                            | 41 (11.0; 7.8-14.2)   |
| Chest + abdomen                  | 14 (3.8; 1.8-5.7)     |
| Chest                            | 10 (2.69; 1.0-4.3)    |
| Angiograms                       | 7 (1.88; 0.5-3.3)     |
| Neck region                      | 4 (1.08; 0.0-2.1)     |
| Multiple regions                 | 14 (3.77; 1.8-5.7)    |
Table 3. Indications for scanning per anatomic region

| Indications for CT scan* | Frequency (%; 95% CI) |
|-------------------------|-----------------------|
| **Head & facial bones** | **Frequency (%; 95% CI)** |
| Suspected stroke/transient ischemic attack/hypertensive emergency | 86 (27.0; 22.2–31.9) |
| Trauma | 45 (14.1; 10.3–18.0) |
| Persistent headaches, blurred vision, suspected space-occupying lesion | 44 (13.8; 10.0-17.6) |
| **Chest** | **Frequency (%; 95% CI)** |
| Suspected pulmonary embolism | 7 (2.2; 0.6–3.8) |
| Chronic cough | 4 (1.2; 0.0-2.5) |
| Tumor workup | 2 (0.6; 0.0-1.5) |
| **Abdomen/Pelvis** | **Frequency (%; 95% CI)** |
| Pain, acute abdomen | 18 (5.7; 3.1–8.2) |
| Suspected tumor, mass | 22 (6.9; 4.1–9.7) |
| Urinary symptoms | 15 (4.7; 2.4-7.0) |
| **Spine** | **Frequency (%; 95% CI)** |
| Back ache (severe, chronic, persistent) | 28 (8.8; 5.7-11.9) |
| Suspected cord compression | 9 (2.8; 1.0-4.6) |
| Trauma | 6 (1.9; 0.4-3.4) |

*Data available for 318 respondents

Risk of financial hardship after using CT

Among study participants, 246 out of 344 (72% [95%CI: 67%-76%]) declared having “just enough” or “less than enough” money to cater for their bills, food and clothing after paying for the scan, indicating risk of financial hardship. A hundred and two respondents out of 370 (28% [95%CI: 23–32%]) reported to have negotiated for direct cost reduction, with 44 (43% [95%CI: 34%-53%]) doing so formally through the hospital Social Services or the administration and 58 (57% [95%CI: 47%-66%]) informally through healthcare staff directly related with service provision. Table 4 shows the relationship between some selected variables and risk of financial hardship on univariate and multivariable analyses.
Table 4. Risk of financial hardship after CT use

| Variables                      | Univariate          | Multivariate         |
|--------------------------------|---------------------|----------------------|
|                                | Odds ratio (95% CI) | P value              | Adjusted Odds ratio (95% CI) | P value |
| Age (years; N = 344)           | 1.00 (0.98–1.01)    | 0.723                | 0.96 (0.94–1.00)              | 0.067   |
| Sex (N = 344)                  |                     |                      |                                   |
| Female                         | 1.55 (0.96–2.50)    | 0.070                | 1.37 (0.71–2.65)               | 0.357   |
| Male                           | ref                 | ref                  | ref                              |         |
| Marital status (N = 344)       |                     |                      |                                   |
| Married/living in union        | ref                 | ref                  | ref                              |         |
| Single/divorced/widow          | 1.36 (0.83–2.24)    | 0.222                | 1.49 (0.69–3.2)                | 0.309   |
| Educational level (N = 319)    |                     |                      |                                   |
| ≤O level                       | 2.42 (1.44–4.06)    | 0.001                | 1.66 (0.78–3.55)               | 0.187   |
| >O level or equivalent         | ref                 | ref                  | ref                              |         |
| Employment status (N = 266)    |                     |                      |                                   |
| Employed (formally, informally, self) | ref | ref                  | ref                              |         |
| Unemployed/Retired             | 1.05 (0.60–1.86)    | 0.855                | 1.81 (0.66–4.99)               | 0.253   |
| SES (N = 342)                  | 0.20 (0.12–0.34)    | < 0.001              | 0.19 (0.10–0.38)               | < 0.001 |
| Health insurance ownership (N = 342) | ref | ref                  | ref                              |         |
| Yes                            | 6.28 (2.73–14.45)   | < 0.001              | 3.59 (1.31–9.85)               | 0.013   |
| Chronic illnesses (N = 369)    |                     |                      |                                   |
| Yes                            | 1.36 (0.82–2.24)    | 0.233                | 1.37 (0.70–2.68)               | 0.361   |
| No                             | ref                 | ref                  | ref                              |         |
| Model R² = 0.1885; p < 0.001.  |                     |                      |                                   |

Qualitative findings

Of the twenty-eight participants who accepted to be contacted for phone interviews, twenty-two were effectively interviewed. Two could not be reached by phone after several attempts, three others were not disposed for a conversation at the appointed time (one in a public transport vehicle and two in meetings), and one had just died and so the caregiver could not commit to the interview. Table 5 summarizes the characteristics of the persons interviewed.

Table 5. Characteristics of interviewees

| Number of respondents | 22 |
|-----------------------|----|
| Male                  | 9  |
| Female                | 13 |
| Mean age (SD), years  | 49.7 (9.9) |
| Duration of interviews (minutes: min; max) | 10 ; 18 |
| Employment status     | Self-employed | 8 |
|                       | Retired    | 8 |
|                       | Unemployed | 3 |
|                       | Employed with a formal contract | 3 |
| Person interviewed    | Patient | 16 |
|                       | Patient’s caregiver | 6 |
Coping With CT Use

Family solidarity

It was reported by some respondents that close family relatives had to be called up for financial assistance. Persons called up were not limited to the nuclear family as they included other relatives and even close friends.

“... my husband is a logger and works for himself ... since he has been down with sickness it is not easy so I have to support him financially ... I sell pea nuts” (P01; caregiver of 38-year old male patient)

“We had to pay for the scan. She is not working and the doctor had planned to operate her ... where was she supposed to get the money from?” (P08; caregiver of 28-year-old female patient)

“... we came prepared ... my mother paid for everything” (P09; caregiver of 56-year old male patient)

Exonerations

Some respondents declared to have benefitted from some sort of fee-reduction scheme. This happened through mainly two pathways: fee reduction approved by hospital administration or Social Services, and through staff directly involved with the provision of services. The former was reported by persons who either claimed to personally know some members of the administration, belonged to the same ethnic group, attended same church, or upon recommendation from a political or local administrative figure. The benefits ranged from totally free direct cost to reductions of up to 75%. For fee reduction obtained through healthcare staff, beneficiaries hoped economic hardship would predispose them to strive for direct personal gain thus open for a bargain. Some clients would even pose as a staff relative so as to “soften” the negotiations.
“I had to give part of the money for the scan to the “nurse” first ... I told him I cannot run away since my patient is admitted in the hospital” (P18; caregiver of 52-year old male patient)

“... pension is how much? The government doesn’t know what the people are going through ... as a senior citizen I had to ask the director for a reduction and he cut the cost by two” (P02; 61 years old, female)

“... I know the director personally ... so I went to him [director] for consultation and he prescribed the scan himself and asked me to pay 50% of the cost” (P10; 31 years old, male)

“I explained my situation [financial] to the person I met who offered to help me ... so I gave him what I had” (P11; 43 years old, female)

**Borrowing of money**

Having to borrow money from neighbors, friends and small common interest groups was also reported as a means of raising money to pay for CT when the need arose.

“I was pushed to borrow money because I was not feeling fine at all” (P04; 42 years old, female)

“I had to stretch my hands to my neighbors ... I am on a loan” (P21; 56 years old, male)

**CT Utilization Despite Reported Hardship**

One of the triggers to promptly get CT scan done despite complaining of financial hardship was the fact that the client/patient was in pain. Also, some caregivers believed their patient was not receiving any medical care or treatment and only after CT scan would any form of treatment be commenced. Furthermore some users had the understanding that CT scanning was necessary to determine the cause of ill health and therefore guide treatment. To others CT scan was considered to be a kind of “one-stop-shop” test for the
entire body and was expected to “reveal any anomaly” besides the present complaint.

“My patient was feeling some hot pains so we had no choice but to run up and down to mobilize the funds to get the scan done” (P01; caregiver of 38-year old male patient).

“... I am feeling very bad ... cannot walk right now ... I had to do it [CT] so that my entire body could be properly checked” (P06; 66 years old, male)

Deterrents To CT Use And Missed Opportunities

Fear

This was manifested by not showing up for CT scan despite having received a prescription from a healthcare provider (for clients who had to do a repeat CT). The reasons were varied: no money as previous experience showed the cost was substantial, resentment of the attitude of hospital staff by clients who feared being ridiculed should they present with insufficient funds, the scare of the equipment as one is left “alone” inside the room, and also the fact that the machine uses x-rays which should have a long term effect in “reducing the lifespan”.

“... money issues otherwise we were supposed to have done another CT scan following treatment ... ” (P01; caregiver of 38-year old male patient)

“If you dare go to hospital without money do you know what the staff can do to you?” (P03; 62 years old, female)

“The machine is scary ... didn’t like being left alone in the room ... not my first time doing CT scan and I am already afraid of the effect of the rays on my body” (P17; 56 years old, male)

Ignorance

Some study participants did not dare to believe that services could be provided in emergency situations before the financial obligations are met. They remained adamant
when this was explained and relied heavily on their past experiences with using health care services where pre-payment was mandatory.

Also there was no knowledge of the Social Action Service, a department within the hospital facility that identifies paupers within the community and also screens some service users who declare they cannot pay for services, to determine eligibility for fee reduction.

Discussion

Triangulation was used to integrate both quantitative and qualitative data. In the quantitative analysis a low socioeconomic status and not having any form of financial protection for health were associated with risk of financial hardship after CT use. The qualitative data revealed different coping strategies to reduce the burden of OOP payments for CT. These coping mechanisms have consequences for the health facility such as the loss of income through wanton exoneration and the encouragement of corrupt practices by some staff. In addition to coping with CT use, the qualitative phase further identified potential barriers to CT use that could be taken advantage of to improve upon the experience of having to use CT.

If a lower socioeconomic status would mean less financial viability, then both quantitative and qualitative strands of the study agree that persons with a low SES are at risk of impoverishment after CT use.

Jason et al. reported an increased likelihood of economic insecurity among men getting towards retirement [35]. We did not find any association between risk of impoverishment and age in this study.

There was some dissonance with the findings as employment status was not associated with risk of financial hardship in the quantitative analysis but was a relevant factor in the qualitative analysis. Being unemployed, retired or temporarily out of work was linked with the inability to pay for the direct cost of CT.
In this study, the qualitative phase brings out additional information to complement the quantitative. Furthermore, there are areas of convergence and dissonance of findings, permitting a broader perspective that cuts across both strands of the study. This study gives insight into the financial barriers of CT utilization in the study setting and potential impact, reveals threats to the current organizational culture and suggests avenues for improvement.

The goal of universal health coverage (UHC) is to enable all persons use needed health services without risk of financial impoverishment [19]. This is mainly through the protection of potential service users from the negative impact of unaffordable out-of-pocket payments for health services. OOP payments for health services cause financial hardship, deter people from seeking or continuing care, can push entire households further below the poverty line (impoverishment) or require they forego other basic necessities [19, 36]. Improving access to healthcare services is an important step towards achieving UHC [18]. Bringing CT to peripheral health facilities is a commendable effort. However, other dimensions of access such as affordability and acceptability would have to be fulfilled for UHC to become a reality.

**Strengths and limitations**

During this study, attempts were made to improve upon the validity and credibility of the findings. These include content validation of the quantitative data collection tool and pre-testing. The quantitative data was collected by a trained research assistant who was not part of the investigators. Qualitative data were collected by a single researcher and were independently reviewed by two investigators with a different research background (social sciences and public health). Categorization of the findings was consensual.

Some limitations to this study exist. Firstly, the main outcome of the quantitative phase was self-reported and so reporting bias may have occurred. There are also concerns of
reflexivity and power as the qualitative phase interviews were conducted by the PI, whose worldview and intuition could have influenced the reporting. Nevertheless, the absence of physical contact during the interviews might have limited the power gradient to some extent. Also, some participants could not be reached by phone or were not disposed for an interview when calls were made. We further report that no software was used for qualitative data analysis given the diversity of languages used for the interviews and unavailability of appropriate software.

Conclusion

The risk of financial hardship is a real threat to CT utilization for persons of low socioeconomic status without any form of financial risk protection. However, CT users in the study setting have had to adapt to cope with this reality so as to minimize the financial burden of OOP payments for CT scans. It is our opinion that policies capitalizing on the opportunities to improve CT affordability would help reduce financial impoverishment and the negative consequences of the coping strategies used by some CT users.

Abbreviations

CT: computed tomography; OOP: out-of-pocket; SES: socioeconomic status; PI: principal investigator; CI: confidence interval; UHC: universal health coverage

Declarations

Ethics approval and consent to participate

Ethical approval for this study was obtained from The University of Yaoundé 1 Ethics Committee (108/UY1/FMSB/VDRC/CSD) and the Institutional Ethics Committee of Regional Hospital Limbe (002-03/2018/IEC-RHL). The study was conducted in accordance with the Helsinki Declaration. Participation was voluntary and participants were informed they
could withdraw at any time should they choose to do so without any repercussion on their care. Informed consent was both oral and written. Participants were assured the information obtained from them was recorded anonymously and would be used confidentially, just for the purpose of the study.

Consent for publication

Not applicable

Competing interests

The authors declare that they have no competing interests

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None

Authors’ contributions

JT conceived the study and participated in study design, data collection, analysis and drafting of the manuscript. LM participated in study design, supervised data analysis and proof-reading of the manuscript. POZ participated in study design and corrected the final draft of the manuscript. GN-T and AE participated in data collection and analysis. VM-N and JZM provided advice during the study and corrected drafts of the manuscript. All authors approved the final version of the manuscript.

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Availability of data and materials

The datasets used and analyzed during this study are available from the corresponding author upon reasonable request.

References

1. Shadmi E, Balicer RD, Kinder K, Abrams C, Weiner JP. Assessing socioeconomic health
care utilization inequity in Israel: impact of alternative approaches to morbidity adjustment. BMC Public Health. 2011;11:609. doi:10.1186/1471-2458-11-609.

2. Regidor E, Martínez D, Calle ME, Astasio P, Ortega P, Domínguez V. Socioeconomic patterns in the use of public and private health services and equity in health care. BMC Health Serv Res. 2008;8:183. doi:10.1186/1472-6963-8-183.

3. Filc D, Davidovich N, Novack L, Balicer RD. Is socioeconomic status associated with utilization of health care services in a single-payer universal health care system? Int J Equity Health. 2014;13:115. doi:10.1186/s12939-014-0115-1.

4. Coory M, Scott IA, Baade P. Differential effect of socioeconomic status on rates of invasive coronary procedures across the public and private sectors in Queensland, Australia. J Epidemiol Community Health. 2002;56:233–4. doi:10.1136/jech.56.3.233.

5. Adler NE, Ostrove JM. Socioeconomic status and health: what we know and what we don’t. Ann N Y Acad Sci. 1999;896:3–15. doi:10.1111/j.1749-6632.1999.tb08101.x.

6. Adler N. Socioeconomic status and health: the challenge of the gradient. Am Psychol. 1994;49:15–24. doi:10.1021/jo901279g.

7. Brunner E, Marmot M. Social organization, stress and health. In: Marmot M, Wilkinson R, editors. Social Determinants of Health. 2nd edition. New York: Oxford University Press; 1999. p. 17–43.

8. Marmot M. Social determinants of health inequalities. Lancet. 2005;365:1099-104. doi:10.1016/S0140-6736(05)71146-6.

9. Whitehead M, Dahlgren G. Concepts and principles for tackling social inequalities in health: Leveling up Part 1. Copenhagen: WHO Regional Office for Europe; 2006.

10. Marmot M. Fair Society, Healthy Lives: The Marmot Review. UCL Institute of Health Equity; 2010.

11. Brenner DJ, Hall EJ. Computed Tomography — An Increasing Source of Radiation
12. Bhayana R, Vermeulen MJ, Li Q, Hellings CR, Berdahl C, Schull MJ. Socioeconomic status and the use of computed tomography in the emergency department. CJEM. 2014;16:288-95. doi:10.2310/8000.2013.131102.

13. Demeter S, Reed M, Lix L, MacWilliam L, Leslie W. Socioeconomic status and the utilization of diagnostic imaging in an urban setting. Can Med Assoc J. 2005;173:1173-7. http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed7&NEWS=N&AN=2005519640.

14. Kung P-T, Tsai W-C, Hu H-Y. Disease Patterns and Socioeconomic Status Associated with Utilization of Computed Tomography in Taiwan, 1997–2003. J Formos Med Assoc. 2008;107:145–55. doi:10.1016/S0929-6646(08)60128-X.

15. Pearce MS, Salotti JA, McHugh K, Pyo Kim K, Craft AW, Lubin J, et al. Socio-economic variation in CT scanning in Northern England, 1990-2002. BMC Health Serv Res. 2012;12:24. doi:10.1186/1472-6963-12-24.

16. Coburn N, Przybysz R, Barbera L, Hodgson DC, Laupacis A, Law C. Evaluation of CT and MRI scanning among cancer patients in Ontario. Clin Imaging. 2011;35:301-8. doi:10.1016/j.clinimag.2010.07.007.

17. Becker J, Jenkins LS, De Swardt M, Sayed R, Viljoen M. Appropriateness of computed tomography and magnetic resonance imaging scans in the Eden and Central Karoo districts of the Western Cape Province, South Africa. South African Med J. 2014;104:762. doi:10.7196/SAMJ.8158.

18. Evans DB, Hsu J, Boerma T. Universal health coverage and universal access. Bull World Health Organ. 2013;91:546-546A. doi:10.2471/BLT.13.125450.

19. The World Health Report 2013: Research for universal health coverage. Luxembourg: World Health Organization; 2013.
20. Creswell J, Clark V. Designing and conducting mixed methods research. 3rd edition. Thousand oaks, CA: SAGE; 2017.

21. Terell S. Mixed-methods research methodologies. Qual Rep. 2012;17:254-80.

22. Barbour RS. The Case for Combining Qualitative and Quantitative Approaches in Health Services Research. J Health Serv Res Policy. 1999;4:39-43. doi:10.1177/135581969900400110.

23. Bowen P, Rose R, Pilkington A. Mixed methods - theory and practice. Sequential, explanatory approach. Int J Quant Qual Res Methods. 2017;5:10-27.

24. Roberts K, Dowell A, Nie J-B. Attempting rigour and replicability in thematic analysis of qualitative research data; a case study of codebook development. BMC Med Res Methodol. 2019;19:66. doi:10.1186/s12874-019-0707-y.

25. Creswell J. Research design: qualitative, quantitative, and mixed methods approaches. 2nd edition. Thousand oaks, CA: SAGE; 2003.

26. Teddlie C, Yu F. Mixed Methods Sampling. J Mix Methods Res. 2007;1:77-100. doi:10.1177/155868980629118183.

27. Kuper A, Lingard L, Levinson W. Critically appraising qualitative research. BMJ. 2008;337 aug07 3:a1035-a1035. doi:10.1136/bmj.a1035.

28. Bartlett II JE, Kotrlik JW, Higgins CC. Organizational research: Determining appropriate sample size in survey research. Inf Technol Learn Perform J. 2001;19:43-50.

29. Morse JM. Determining Sample Size. Qual Health Res. 2000;10:3-5. doi:10.1177/104973200129118183.

30. Guest G, Bunce A, Johnson L. How Many Interviews Are Enough?: An Experiment with Data Saturation and Variability. Field methods. 2006;18:59-82. doi:10.1177/1525822X05279903.
31. Fezeu L, Minkoulou E, Balkau B, Kengne A-P, Awah P, Unwin N, et al. Association between socioeconomic status and adiposity in urban Cameroon. Int J Epidemiol. 2006;35:105-11. doi:10.1093/ije/dyi214.

32. Conklin Al, Forouhi NG, Suhrcke M, Surtees P, Wareham NJ, Monsivais P. Socioeconomic status, financial hardship and measured obesity in older adults: a cross-sectional study of the EPIC-Norfolk cohort. BMC Public Health. 2013;13:1039. doi:10.1186/1471-2458-13-1039.

33. Ryan GW, Bernard HR. Techniques to Identify Themes. Field methods. 2003;15:85-109. doi:10.1177/1525822X02239569.

34. O’Cathain A, Murphy E, Nicholl J. Three techniques for integrating data in mixed methods studies. BMJ. 2010;341 sep17 1:c4587-c4587. doi:10.1136/bmj.c4587.

35. Brown J, Dynan K, Figinski T. The Risk of Financial Hardship in Retirement: A Cohort Analysis. 2019.
https://scholar.harvard.edu/files/kdynan/files/brown_dynan_figinski_final_working_paper.pdf
Accessed 4 Jan 2020.

36. Saksena P, Hsu J, Evans DB. Financial Risk Protection and Universal Health Coverage: Evidence and Measurement Challenges. PLoS Med. 2014;11:e1001701. doi:10.1371/journal.pmed.1001701.

Figures
Figure 1

Study diagram.