Scoping review

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Scoping review: bladder cancer in Nigeria – what are the gaps in clinical care and research?

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ABSTRACT

Objectives There are currently no national guidelines regarding bladder cancer treatment and clinical care pathways in Nigeria. The aim of this scoping review was to identify any gaps in the knowledge of epidemiology, clinical care and translational research in order to aid the development of a defined clinical care pathway and guide future research.

Methods A scoping review was conducted by searching Medline, Ovid Gateway, The Cochrane library and Open Grey literature using predefined search terms from date of inception to June 2020. Studies were included if they discussed the epidemiology or treatment pathway of bladder cancer. All data were charted and were analysed in a descriptive manner. A consultation phase was also conducted consisting of a multidisciplinary team of clinicians and bladder cancer survivors.

Results A total of 19 studies were deemed suitable for inclusion. The themes included the epidemiology of bladder cancer (high prevalence of schistosomiasis), research surrounding the biology of the disease and translational research including potential biomarkers. The consultation phase highlighted some possible sociocultural and infrastructural issues relating to both the diagnosis and treatment of bladder cancer, with poor knowledge of bladder cancer and its symptoms within the general population identified as a key issue.

Conclusion Even though the factors surrounding the relationship between schistosomiasis and the histopathology of bladder cancer remain unclear, there is potential for screening for schistosomiasis in endemic regions of sub-Saharan Africa. Other key areas for future research include the dissemination of information to the general population surrounding bladder cancer and its symptoms to encourage prompt diagnosis.

Strengths and limitations of this study

- Grey literature was included as well as indexed journal articles to allow for the collation of data from a variety of sources.
- A consultation phase consisting of a multidisciplinary group of clinicians as well as two bladder cancer survivors was included in the review.
- It is possible that some relevant studies were not accessible on the search engines used for this review, and so some studies may have been overlooked.
- However, our search strategy was methodically developed and several databases were accessed and so we consider this to be unlikely.

INTRODUCTION

Being the 10th most common cancer globally, bladder cancer (BC) accounts for 3% of all new cancer cases and 2% of all cancer mortalities.[1] The incidence is rising in Africa, with the highest rates recorded in North Africa. The incidence in North Africa and sub-Saharan Africa have been reported, respectively, as 10.1 and 5.0 per 100 000 for males and 2.0 and 1.5 per 100 000 for females. BC ranks 7th overall (2nd in males and 11th in females) in Nigeria.[2]

The stage groupings of non-muscle-invasive (NMIBC) and muscle invasive (MIBC) are accepted descriptors of BC in developed countries, with 75%–80% of new cases categorised as the former category and 20%–25% as the latter.[3] BC can also be classified into two main groups: urothelial and non-urothelial.[4] In developed countries, urothelial carcinoma or transitional cell carcinoma (TCC) is the predominant histological subtype of BC,[5 6] comprising around 90% of all BC cases.[6] Risk factors for TCC include smoking[7] and exposure to chemicals in the dye industry.[8] As it usually presents at an early stage without detrusor muscle involvement (NMIBC), it is associated with a good prognosis.[9]

However, in low/middle-income countries, such as those within the Middle East and parts of Africa, squamous cell carcinoma (SCC), which is the most common variant of non-urothelial carcinoma, is often

more prevalent than TCC. SCC itself has two main subtypes: schistosomiasis(Bilharzia)-associated and non-schistosomiasis-associated SCC, although it is important to note these do not differ morphologically. In the Middle East and parts of Africa where *Schistosoma haematobium* infection is endemic, schistosomiasis-associated SCC is most common. SCC is a more aggressive disease with a poorer prognosis when compared with TCC.[10] In Northern Nigeria, SCC is the most frequent subtype of BC representing 53% of cases despite the lower prevalence of schistosomiasis in Northern Nigeria.[11–13] Meanwhile, in Southern Nigeria, it has been reported that around 20% of BCs were SCC with a higher prevalence of schistosomiasis than in the north.[14 15] This highlights the possible role of a yet to be identified environmental and/or genetic factor(s), explaining the disparity in histologic type between the northern and southern part of the country.

With a paucity of published evidence relating to the epidemiology, clinical treatment and translational research into BC in Nigeria, this scoping review aims to identify gaps in clinical care and research on BC in Nigeria.

METHODS

Our methodology for this scoping review was developed based on the Joanna Briggs Institute guidelines[16] and, more specifically, the framework developed by Arksey and O'Malley.[17] Unlike other reviews such as systematic reviews which tend to address a precise research question, a scoping review can be used to map and summarise available evidence on a particular subject.[16] They can be conducted for a variety of reasons. This current scoping review was conducted with the aim of identifying the types of available evidence on BC research in Nigeria, with the overall aim of identifying knowledge gaps in this area. Preferred Reporting Items for Systematic Reviews and Meta-Analyses-Scoping Reviews extension for scoping reviews[18] were followed to ensure all suggested items were reported. A detailed protocol of this scoping review has been published previously[19] and a brief summary is presented in figure 1.

The following research question was developed in consultation with the research and clinical teams:

'What is known about the epidemiology and treatment pathway of BC in Nigeria?'. Medline (using the PubMed interface), Ovid Gateway (Embase and Ovid) (search terms available in online supplemental file 1), The Cochrane library and Open Grey literature were searched for relevant studies between June and July 2020. A separate search for grey literature was conducted by the team in Nigeria through National Postgraduate Medical College of Nigeria, West African College of Surgeons (WACS) and Nigerian Association of Urological Surgeons (NAUS). In addition, verbal communication with most of the tertiary health institutions was instigated to determine the existence of institutional-based protocols.

All types of study design were considered for inclusion if they assessed the themes of prevention, diagnosis, treatment, survivorship or translational research regarding BC in Nigeria. All published studies (excluding grey literature) underwent a critical appraisal using the Joanna Briggs Institute critical appraisal forms (online supplemental file 2).[16] Two independent reviewers charted the data, and the studies identified were analysed using a qualitative method. The studies were split into several subthemes: prevalence, prevention, diagnosis, treatment, survivorship and translational research/biology.

RESULTS

A total of 76 records were identified through database searching after removing duplicates (figure 2). After screening by title and abstracts, 46 full texts were assessed for eligibility. In total, 19 studies were deemed suitable for inclusion. Of the 19 studies included, 3 were identified through the grey literature search. Initially, the search identified 16 grey literature including six dissertations,

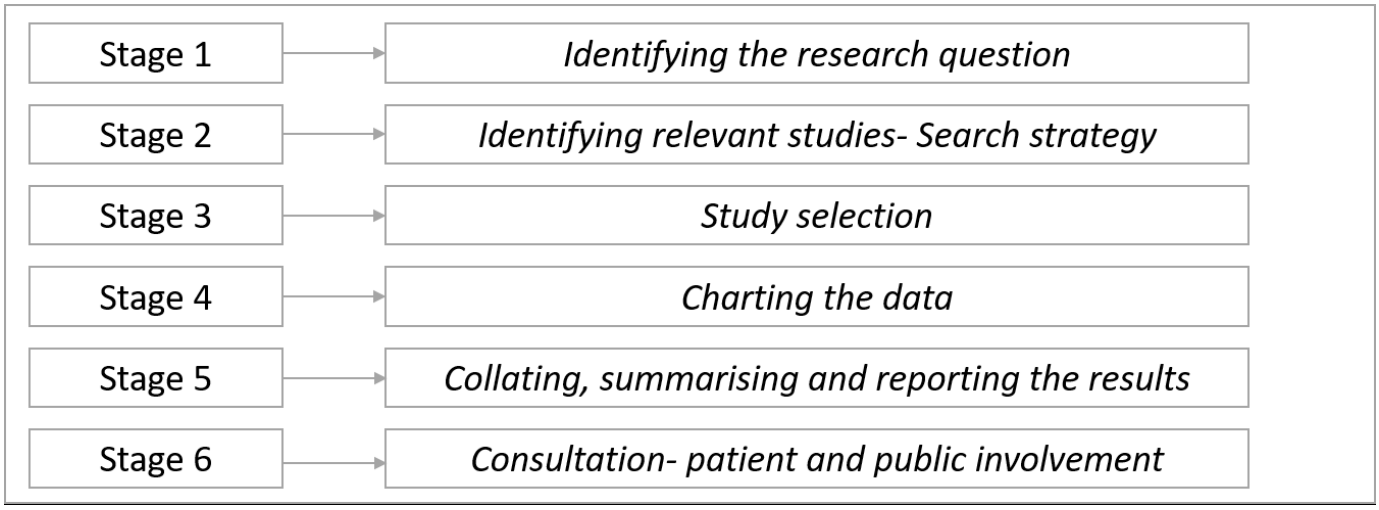

Figure 1 Stages of scoping review.

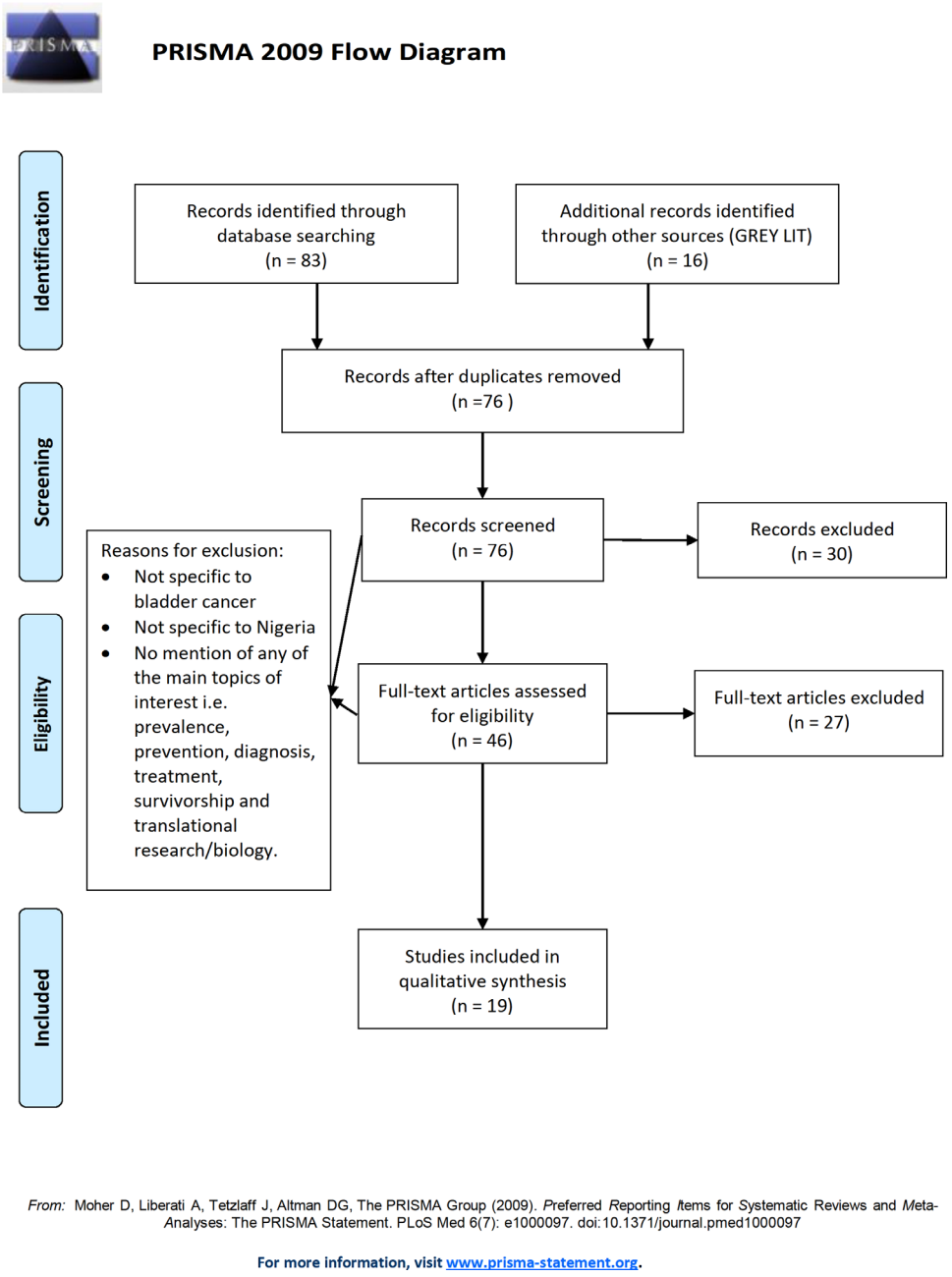

Figure 2 PRISMA flow chart. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

8 conference abstracts and 2 local audits. Thirteen were subsequently excluded during the screening process.

Six studies described the prevalence of BC within the various regions of Nigeria and each listed the prevalence of TCC versus SCC[12–14 20–22] (tables 1 and 2 and online supplemental file 3). The case series by Ochicha *et al*[12] and Yunusa *et al*[22] presented the characteristics of BC patients in Kano (northwest), while the results from Mungadi and Malami[13] were from Sokoto, also in the northwest. In Kano, the prevalence of TCC was reported to be 35% vs 53% for SCC according to Ochicha *et al*,[12] and 44% SCC vs 29% TCC in the audit by Yunusa *et al*.[22] Similarly, Mungadi and Malami stated that the majority (65%) of BC patients had SCC.[13] Both studies mentioned that there was a strong association between the endemic areas of schistosomiasis and SCC. Meanwhile and Mbonu[20] and Takure *et al*[14] described the prevalence of BC types in Enugu (southeast) and Ibadan (southwest), respectively. The study by Aghaji *et al* stated that 56% had TCC and 39% had SCC, while Takure *et al* concluded that 69% of BC patients had TCC and 20% had SCC.

A common theme among the studies was the need to control the infection of *S. haematobium* for the prevention of BC[13 23–25] (tables 1 and 2). The study by Umar *et al*[25] recommended the implementation of the WHO's mass treatment if the infection of Schistosoma haematobium infection is above 50% within a local authority. Ossai *et al*[23] observed a high prevalence of bacteriuria and urinary schistosomiasis in primary school children, which consequently could portend an increased risk of BC in the

Table 1 Overview of included articles

Study ref	Authors and year	Which region of Nigeria	Aims/ objectives	Population
1	Ossai *et al*[23] 2012	Enugu state, south eastern Nigeria	To investigate current prevalence of urinary schistosomiasis and co-infection with bacteriuria in Enugu	842 primary school children (5–15 years)
2	Oyeyemi *et al*[26] 2018	Ilumafon, Ijebu, NorthEast, Ogun state,	To assess the relationship between serum bladder tumour antigen with urinary aflatoxin	22 participants
3	Bakare *et al*[33] 2018	Eggua in southwest Nigeria	To determine the association of schistosomiasis and arsenicosis with bladder pathologies	122 participants
4	Ochicha *et al*[12] 2003	Kano	To document the pattern of bladder cancer in kano	89 bladder cancer patients
5	Aghaji *et al*[20] 1988	Enugu	Describe the clinicopathological features of bladder tumours	103 patients diagnosed with bladder tumours
6	Onile *et al*[24] 2016	Eggua, Yewa, Ogun state, Nigeria	To determine prevalence of schistosomiasis and associated bladder pathology in adults in Eggua.	257 participants (aged 30+)
7	Muhammad *et al*[29] 2019	Sokoto state	To compare the sensitivity, specificity, and predictive values of bladder tumour antigen quantitative test (BTA TRAK) and urine cytology in the diagnosis of bladder carcinoma in a schistosoma endemic area.	88 participants (52 participants who had features of bladder carcinoma. The control group had 36 participants who had had haematuria from other urological conditions)
8	Takure *et al*[14] 2015	Ibadan, Southwest Nigeria	To provide an update on the histopathologic pattern of bladder cancers in Ibadan	216 bladder cancer patients
9	Ikuerowo *et al*[31] 2018	Lagos	To report the experience and the outcome of our patients who had this procedure.	Patients who had Radical cystectomy and Mainz II pouch urinary diversion for muscle-invasive bladder cancer from 2007 to 2016 were evaluated.
10	Shu'aibu *et al*[32] 2012	Jos	To report experience with radical cystectomy and W-ileal pouch construction in patients with muscle invasive transitional cell urinary bladder carcinoma.	6 patients diagnosed with muscle invasive transitional cell bladder carcinoma (T2-3/N0/M0)
11	Onile *et al*[28] 2017	Eggua, South-West Nigeria	To identify biomarkers among the infected population, which will influence early detection of the disease and its subtle morbidity.	Urine samples for 49 volunteers from Eggua, a schistosomiasis endemic community in South-West, Nigeria.
12	Akinwale *et al*[34] 2008	Imala Odo, Abeokuta North Local Government Area of Ogun state, Southwest Nigeria	to screen exfoliated cells in the urine of *Schistosoma haematobium*-infected patients for squamous cell abnormalities through cytopathological examinations.	A total of 32 infected individuals and 10 uninfected controls (aged between 40 and 55 years)
13	Ita *et al*[41] 2019	Jos	To describe the case of a Nigerian male with transitional cell carcinoma of the bladder in whom larvae of *Strongyloides stercoralis* was identified in the urine.	one patient

Continued

Table 1 Continued

Study ref	Authors and year	Which region of Nigeria	Aims/ objectives	Population
14	Mungadi and Malami[13] 2007	Sokoto, North Western Nigeria	To determine the epidemiological characteristics of bladder cancer in the region and to assess the impact of schistosomiasis on these cases.	133 bladder cancer patients
15	Oyeyemi *et al*[27] 2018	Ogun state	To find the incidence of urinary bladder thickness and evaluate the relationship between BTA and BWT in a low schistosomiasis-endemic Nigerian village.	56 individuals were screened using chemical reagent strips and then diagnosed microscopically for *S. haematobium*.
16	Umar *et al*[25] 2016	Kano, Northern Nigeria	To determine the prevalence and human risk factors of *S. haematobium* infections in Farawa and Koya dam-site communities in Minjibir Local Government Area of Kano State, Northern Nigeria.	120 individuals
17	Yunusa *et al*[22] 2016	Northern western	To review the burden, pathology and clinical management of bladder cancers in Kano, North-western Nigeria	Patients seen and diagnosed to have bladder cancer
18	Sani[30] 2018	North-Western	To determine the efficacy of urine cytology in the diagnosis of bladder cancer, in Aminu Kano Teaching Hospital	52 patients with suspected bladder cancer
19	Salako *et al*[21] 201	South-western Nigeria	To report the changing trend of TCC in our practice at the Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Nigeria.	38 bladder cancer patients

BTA, bladder tumour antigen; BWT, bladder wall thickness; TCC, transitional cell carcinoma.

Table 2 Identified research gaps and policy recommendations

Study ref	Authors	Theme	Type of recommendation	Research gaps/recommendation for actions
1	Ossai *et al*[23]	Prevention	Policy	► There is a need for intensive health education to sensitise the people on the risk of urinary schistosomiasis and its co-infection with bacteriuria. ► This could be done through community dialogue
2	Oyeyemi *et al*[26]	Translational/ biology	Research and policy	► Need for a study with larger sample size and possibly aflatoxin exposure analysis by serum AF-alb rather than urinary aflatoxin M1 (AFM1) or even a combination of both biomarkers to validate initial this observation of the study. ► Study on the role of schistosomiasis in bladder cancer through biomonitoring of human BTA. ► Community education of rural agrarian households on best practices to mitigate mycotoxin exposure in farm produce.
3	Bakare *et al*[33]	Translational/ biology	Research	► Need for a study with larger sample size to study association of schistosomiasis and arsenicosis with bladder pathologies.
4	Ochicha *et al*[12]	Prevalence	N/A	N/A
5	Aghaji *et al*[20]	Prevalence	Research and policy	► Improve education and diagnostic techniques ► Improve therapeutic facilities to reduce morbidity and mortality rates will fall. ► Understand impact of socioeconomic status (SES) on presentation
6	Onile *et al*[24]	Translational/ biology/ prevention	Research	► Further research on the determinants and progress of the bladder pathologies in *Schistosoma haematobium* infected Nigerian adults.
7	Muhammad *et al*[29]	Diagnosis and translational	N/A	► Review the cut-off (of 54 µ/mL) for BTA in the Sokoto region to increase the specificity of the marker for the diagnosis of bladder cancer
8	Takure *et al*[14]	Prevalence	Policy	► Train relevant health professionals to enable them to diagnose and treat bladder cancer in its early stages and thus reduce the high morbidity and mortality associated with advanced disease.
9	Ikuerowo *et al*[31]	Treatment	N/A	N/A
10	Shu'aibu *et al*[32]	Treatment	N/A	N/A
11	Onile *et al*[28]	Translational/ biology/ diagnosis	Research	► Need for validation of biomarkers in a large sample size
12	Akinwale *et al*[34]	Biology	Research	► Improve follow-up of these patients using cystoscopy rather than cytology

Continued

Table 2 Continued

Study ref	Authors	Theme	Type of recommendation	Research gaps/recommendation for actions
13	Ita *et al*[41]	Treatment?	Policy	Implement mandatory investigation of S. stercoralis infection for immunocompromised patients
14	Mungadi and Malami[13]	Prevention and prevalence	N/A	N/A
15	Oyeyemi *et al*[27]	Diagnosis	Research	► The role of urogenital schistosomiasis in urinary BTA levels needs to be further explored.
16	Umar *et al*[25]	Prevention	Policy	► Implementation of WHO's recommendation for mass treatment of the whole community if infection of *S. haematobium* infection is >50% by the local authorities. ► Screening of the community for bladder pathology by ultrasonography is strongly recommended to assess the risk of development of vesical cancer in aged individuals.
17	Yunusa *et al*[22]	Prevention, diagnosis, treatment and survival	Research and policy	► Community based studies to get the exact prevalence. ► More effort in prevention of schistosomiasis at all levels ► Encourage patient to present with early disease through health education. ► Screening to detect early disease and surveillance for people with history of childhood haematuria. ► Better facilities for cystoscopy and biopsy and other tumour markers
18	Sani[30]	Diagnosis, treatment and survivorship	Research and policy	► Routine use of urine cytology as the initial test for evaluating patients with haematuria or suspected bladder cancer is recommended. ► More local studies with longer duration should be done, to allow follow-up of patients over time. In order to validate the importance of urine cytology in detecting recurrence of bladder cancer early in our region. ► More education to public on early features of bladder cancer, to facilitate early presentation and opportunity for curative treatment. ► There should be increase awareness of schistosomiasis
19	Salako *et al*[21]	Prevalence	N/A	N/A

BTA, bladder tumour antigen; N/A, not available.

future. The authors recommended for all primary school children to be screened and treated for bacteriuria.

With respect to the diagnosis of BC and/or schistosomiasis, five studies investigated potential biomarkers and/or the use of urine cytology[26–30] (tables 1 and 2). The two studies by Oyeyemi *et al* looked at the association between bladder tumour antigen (BTA) with other factors. The first of the studies, looked at whether BTA levels were associated with aflatoxin exposure (a fungal metabolite) in Nigerian villagers.[26] The study concluded a null result with no evidence of a link between aflatoxin exposure and BTA. The second study by the same group of authors,

investigated the relationship between BTA and bladder wall thickness (BWT) in a low schistosomiasis-endemic Nigerian village.[27] They reported no association between BWT and BTA and lower urinary tract symptoms, and suggested that the role of urogenital schistosomiasis in urinary BTA levels needed to be explored further. Meanwhile, the study by Muhammad *et al* looked at the role of a quantitative test (BTA TRAK) compared with urine cytology in the diagnosis of BC in the schistosoma endemic area of Sokoto.[29] The authors concluded that BTA TRAK is less specific than urine cytology, but is more sensitive for detecting BC in the area of investigation. The study by Onile *et al* differed in that they identified several parasite-specific and host-specific protein biomarkers for the detection of schistosomiasis.[28] The dissertation, which was identified as part of the grey literature search, was submitted to the WACS as part of the requirements for the award of fellowship of the college in surgery. This dissertation aimed to assess the efficacy of urine cytology in the diagnosis of BC and deemed the use of urine cytology as an effective way of diagnosing patients who present with features indicative of BC.[30]

Two case series reported their experiences of patients undergoing radical cystectomy with different urinary diversion techniques[31 32] (table 1). The first by Ikuerowo *et al* looked at the outcome of a Mainz II pouch urinary diversion in radical cystectomy patients.[31] They concluded that over the 10-year period investigated, 11 patients underwent a Mainz II pouch urinary diversion and overall the technique was deemed safe with good long-term results. The second by Shu'aibu *et al* report their experience of patients who underwent radical cystectomy with a W-ileal pouch construction over a 5-year period.[32] Six patients underwent the procedure, of which only one patient remained alive 5 years after surgery (although two were lost to follow-up). The authors described the technique as a complex procedure requiring highly experienced surgeons and surgical team.

In terms of the biological effects surrounding schistosomiasis, three studies each looked at how this was related to arsenicosis,[33] bladder pathology[24] and urothelial hyperplasia[34] (tables 1 and 2). Bakare *et al* stated that Arsenicosis was a public health concern for the study population of Eggua, situated in South-West Nigeria and that the prevalence of schistosomiasis was 21%.[33] Notwithstanding, there was no association between bladder pathology and arsenicosis or between schistosomiasis associated-bladder pathology and arsenicosis. Also conducted in Eggua, the study by Onile *et al* involved the screening of 257 adults for *S. haematobium* infection and associated bladder pathologies.[24] The prevalence of *S. haematobium* infection was found to be 26% and bladder pathologies were observed in 34% of participants.[24] A large proportion of the patients with bladder pathology also had existing schistosomiasis infection (85%). The study by Akinwale *et al* involved participants from Imala Odo which is also an area within South-West Nigeria.[34] The 780 strong community has no basic infrastructure and is made up of migrant fishing families. The authors observed severely dysplastic malignant squamous cells among a few normal squamous cells in three patients (out of 32). They subsequently state that their results support a Kenyan study which showed an association between urinary tract hyperplasia and *S. haematobium* infection.[35]

The consultation phase included discussion between two consultant urologists, a urology senior registrar, a consultant oncologist, a consultant pathologist, a consultant interventional radiologist, a consultant public health physician, a consultant clinical microbiologist, an oncology pharmacist, a cancer nurse specialist and two BC survivors. The topics of epidemiology, the clinical care pathway and translational research were discussed. There was a general consensus that, although schistosomiasis was endemic in certain areas, this did not always reflect the proportion of SCC versus TCC observed. The clinicians discussed a missing link in this association which was yet to be identified but proposed access to fresh water as a possible cause. In terms of the clinical care pathway, there was an absence of a national standardised pathway. Instead, hospitals would implement local pathways based on personal experiences. The clinicians therefore recommended the development of national guidelines and pathways. Translational research was identified as a rarity in most areas of Nigeria with infrastructure and funding being the main two hindering factors. There was much discussion around the potential benefits of a biobank and better use of the already existing national data registry which at present only captures diagnostic information. The clinicians also spoke about the reluctance by some patients to accept treatments particularly, those that are injectable.

Both of the patient representatives were males of retirement age with no previous family history of BC. They did, however, have very different experiences in terms of their diagnosis and cancer care. Patient A had to undergo seven different hospital visits before undergoing transurethral resection of bladder tumour. Patient B also had initial difficulties in getting access to care, but was financially able to opt for treatment at an alternative hospital for radical cystectomy. The patients spoke about the general lack of awareness of BC in Nigeria and, although neither one refused treatment, patient A decided to also take traditional herbal medicines alongside his medical treatment.

DISCUSSION

The most commonly studied topic was the prevalence of SCC and TCC and its link with schistosomiasis. Despite there being a lack of clarity behind the link between the histopathology of BC and schistosomiasis, it was clear from the review that schistosomiasis is a major problem in Nigeria and there are strong links surrounding an increased risk of BC of any type. Several studies investigated potential biomarkers for BC such as BTA. There was, however, a paucity of studies discussing the clinical

pathways for BC patients in Nigeria. The consultation phase re-iterated many points found in the research articles, including a lack of national guidelines or protocols for the treatment of BC patients.

The results of this review, including the consultation phase with a multidisciplinary group of professionals and patient representatives, have highlighted numerous key issues for which several recommendations are outlined below.

Epidemiology

As presented in this review, there is disparity between the incidence of TCC and SCC in different regions of Nigeria. Despite schistosomiasis being more prevalent in the southern regions of the country,[15] there is not always a clear correlation between schistosomiasis and SCC prevalence, with TCC ever becoming the most common histology nationwide. The studies identified within this scoping review did not investigate this important area of research, but did confirm the higher prevalence of TCC in the south.[14 20] More studies are therefore needed to investigate the factors underlying the link between schistosomiasis and SCC vs TCC prevalence. Another factor which may be important to consider also is tobacco smoking which is a known risk factor for both SCC and TCC.[36 37] Future studies in this area could include ecological analyses to evaluate and incidence of BC types as well as Schistosoma over time.

The prevention and mass treatment of schistosomiasis was investigated within four of the studies from this review; therefore, this area of research is not as neglected as others. Umar *et al* recommended for the utilisation of mass treatment, as suggested by the WHO[25]; however, it is important to note that despite mass drug administration to curb the infection rates, there still remains a lack of transmission control and provision of good water supply which has meant the mortality from the infection has not decreased significantly.[38]

Clinical care pathways

None of the studies identified within this review investigated the clinical care pathways for BC patients in Nigeria, although two did present case series of radical cystectomy patients undergoing different urinary diversion techniques. Interestingly, the study by Shu'aibu *et al*,[32] which investigated the outcomes of patients undergoing an W-ileal pouch urinary diversion, lost two of their six patients during follow-up; this issue emerged during the consultation phase whereby it was suggested that contact with patients post-treatment can be challenging. No other treatment modalities (eg, intravesical therapy, radiotherapy) were mentioned within the literature identified within this scoping review.

At present, the NAUS only have guidelines available for the treatment of prostate cancer patients. Nevertheless, as highlighted during the consultation phase of this review, despite a paucity of national guidelines regarding the treatment pathway for BC patients in Nigeria, this does not mean that patients receive suboptimal care by their treating physicians. Many hospitals, in particular tertiary centres, have developed their own sets of guidelines based on previous experiences; other centres may refer to or adapt existing national/international guidelines that already exist. However, there is still a call for the inauguration of national guidelines to ensure standardisation and continuity of care across the country, and this is a topic worthy of specific future studies.

A topic which was raised during the consultation phase of this review was the lack of communication between the clinical and pharmaceutical aspects of patients' care. For example, the availability of drugs can at times be an issue and can lead to delays in treatment. A recommendation in this area would be for clinical and pharmaceutical departments to collaborate more closely so as to better coordinate the clinical needs for patients within the resources available.

It was highlighted during the consultation phase that the majority of BC patients in Nigeria present at an advanced disease stage and that this is reflected by poor survival statistics (though we do not have data to quantify this). Patients are often of low financial means and from rural areas with insufficient or no medical insurance. A fundamental concern is how to improve this scenario and raise awareness of BC and its symptoms. Hence, patient education is vital and, as highlighted by patient representatives during the consultation phase, knowledge of symptoms and disease risk factors could prompt patients to seek clinical help sooner. Such an awareness campaign has existed for breast cancer in Nigeria and has proved to be effective.[39] Furthermore, non-invasive diagnostic techniques (such as ultrasonography) could be implemented to limit the numbers of patients discouraged in seeking medical consultation by the perception of cystoscopy. In addition, there needs to be a focus on the early diagnosis of patients. As a result of patients being diagnosed in a timely manner, it is hoped this will then allow for the well-being of BC survivors to be investigated. This area of research was lacking in the studies identified within this review and is therefore a recommended area for future research.

Translational research

It was evident from this review that some research had been undertaken surrounding the link between biomarkers and other factors. Two studies, by the same group of authors, looked at the link between BTA and BWT and aflatoxin, with no association identified. BTA-TRAK is a US Food and Drug Administration (FDA) approved immuneassay for the monitoring of BC recurrence when used in conjunction with cystoscopy.[40] It has been noted, however, that while BTA assays have higher sensitivity than urine cytology, the specificity is lower therefore leading to more false-positives.[40] This is an important factor to consider when BTA is being used as a surrogate for BC pathology (as reported by Oyeyemi *et al*[26]).

The BC patients in Nigeria are often from high risk groups such as farmers and fishermen, who are exposed to bodies of water infected with *S. haematobium*. Many patients also have a cultural belief that injectable medicines are harmful and therefore often abscond from treatment. This is particularly difficult for the treating clinician when many beneficial drugs (eg, cytotoxic chemotherapy) are administered intravenously. Therefore, for these patients, education is key. A possible solution would be the adoption of cancer support groups or cancer charities which focus on patients' needs and wellbeing. These groups can be an excellent source of education and emotional support for patients, particularly for those without a stable domestic support system.

Further to the gaps in research highlighted by this review, there is also a challenge in identifying enough clinicians and/or academics to conduct the necessary future research, as well as the enabling of resources and infrastructure. Translational research within a laboratory setting can be a costly affair and usually requires funding through research grants. A future recommendation in this area could be the set-up of local or regional biobanks in order to store tumour specimens for research purposes, although establishing such an infrastructure should be considered in the context of the other priorities outline above.

Strengths and limitations

This review aimed to identify the gaps in clinical care and research for BC in Nigeria as part of the development of a larger national research programme, an endeavour which has not previously been undertaken. We anticipated that there would be a limited number of studies on the subject of interest, and so included grey literature as well as indexed journal articles to allow for the collation of data from a variety of sources. Another strength was the inclusion of a consultation phase with a multidisciplinary group of clinicians as well as two BC survivors. This process gave invaluable information on a personal level which would not have been achieved from the literature alone. We utilised the Joanna Briggs Institute critical appraisal tools to determine whether to include studies in the review. In this case, all studies were deemed suitable for inclusion. It is possible that some relevant studies were not accessible on the search engines used for this review, and so some studies may have been overlooked. However, our search strategy was methodically developed and several databases were accessed and so we consider this to be unlikely.

CONCLUSION

This scoping review has identified several themes regarding the epidemiology and clinical care pathways of BC patients in Nigeria which require further research and development. Despite the existing knowledge of the link between schistosomiasis and SCC, this review highlighted that the correlation between these two diseases is not always clear and can differ between regions. Therefore, the investigation of factors affecting the prevalence of SCC vs TCC and its relationship with *S. haematobium* infection is just one research area requiring attention. There is also a need for both national and hospital guidelines for BC care in Nigeria. Further recommendations include the need to better educate the general population regarding BC and its symptoms to improve early diagnosis. It is hoped that the results and recommendations from this scoping review can pave the way for the development of BC guidelines within Nigeria as well as guiding future research.

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REFERENCES

1 GLOBOCAN. Bladder cancer Factsheet, 2018. Available: https://gco.iarc.fr/today/data/factsheets/cancers/30-Bladder-fact-sheet.pdf [Accessed 03 Mar 2019].
2 Mohammed AZ, Edino ST, Ochicha O, *et al*. Cancer in Nigeria: a 10-year analysis of the Kano cancer registry. *Niger J Med* 2008;17:280–4.
3 Babjuk M, Burger M, Compérat EM, *et al*. European Association of Urology Guidelines on Non-muscle-invasive Bladder Cancer (TaT1 and Carcinoma In Situ) - 2019 Update. *Eur Urol* 2019;76:639–57.
4 Abdel-Rahman O. Squamous cell carcinoma of the bladder: a seer database analysis. *Clin Genitourin Cancer* 2017;15:e463–8.
5 Chavan S, Bray F, Lortet-Tieulent J, *et al*. International variations in bladder cancer incidence and mortality. *Eur Urol* 2014;66:59–73.
6 Lamm DL, Torti FM. Bladder cancer, 1996. *CA Cancer J Clin* 1996;46:93–112.
7 Colombel M, Soloway M, Akaza H, *et al*. Epidemiology, staging, grading, and risk stratification of bladder cancer. *European Urology Supplements* 2008;7:618–26. doi:10.1016/j.eursup.2008.08.002
8 Case RA, Hosker ME, McDONALD DB, *et al*. Tumours of the urinary bladder in workmen engaged in the manufacture and use of certain dyestuff intermediates in the British chemical industry. I. The role of aniline, benzidine, alpha-naphthylamine, and beta-naphthylamine. *Br J Ind Med* 1954;11:75–104.
9 Bowa K, Mulele C, Kachimba J, *et al*. A review of bladder cancer in sub-Saharan Africa: a different disease, with a distinct presentation, assessment, and treatment. *Ann Afr Med* 2018;17:99. doi:10.4103/aam.aam_48_17
10 Scosyrev E, Yao J, Messing E. Urothelial carcinoma versus squamous cell carcinoma of bladder: is survival different with stage adjustment? *Urology* 2009;73:822–7. doi:10.1016/j.urology.2008.11.042
11 Global prevalence of STh and schistosomiasis. Available: https://lshtm.maps.arcgis.com/apps/webappviewer/index.html?id=2e1bc70731114537a8504e3260b6fbc0 [Accessed 03 Jun 2020].
12 Ochicha O, Alhassan S, Mohammed AZ, *et al*. Bladder cancer in Kano--a histopathological review. *West Afr J Med* 2003;22:202–4.
13 Mungadi IA, Malami SA. Urinary bladder cancer and schistosomiasis in north-western Nigeria. *West Afr J Med* 2007;26:226–9.
14 Takure AO, Odubanjo MO, Adebayo SA, *et al*. Histopathologic pattern of bladder cancers in Ibadan Southwest Nigeria: an update. *J West Afr Coll Surg* 2015;5:17-42.
15 Ezeh CO, Onyekwelu KC, Akinwale OP, *et al*. Urinary schistosomiasis in Nigeria: a 50 year review of prevalence, distribution and disease burden. *Parasite* 2019;26:19.
16 Peters M, Godfrey C, McInerney P. Chapter 11: Scoping Reviews (2020 version). In: *Joanna Briggs Institute Reviewer's Manual*, 2020. https://reviewersmanual.joannabriggs.org
17 Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol* 2005;8:19–32. doi:10.1080/1364557032000119616
18 Tricco AC, Lillie E, Zarin W, *et al*. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Ann Intern Med* 2018;169:467–73.
19 Kibaru J, Kotecha P, Iya AM, *et al*. Scoping review protocol: bladder cancer in Nigeria: what are the gaps in clinical care and research? *BMJ Open* 2021;11:e041894.
20 Aghaji AE, Mbonu OO. Bladder tumours in Enugu, Nigeria. *Br J Urol* 1989;64:399–402.
21 Salako A, Badmus T, Akinbola T. Changing trend of transitional cell carcinoma of the bladder in Ile-Ife, South Western Nigeria. *African Journal of Medicine and Medical Sciences* 2019;48 https://www.researchgate.net/publication/343979633_Changing_trend_of_transitional_cell_carcinoma_of_the_bladder_in_Ile-Ife_South_Western_Nigeria
22 Yunusa B, Abdullahi M, Mashi A. Bladder cancer burden and challenges of management in Kano. *North Western Nigeria* 2016 https://www.academia.edu/63015619/Bladder_Cancer_Burden_and_Challenges_of_Management_in_Kano_North_Western_Nigeria
23 Ossai OP, Dankoli R, Nwodo C, *et al*. Bacteriuria and urinary schistosomiasis in primary school children in rural communities in Enugu state, Nigeria, 2012. *Pan Afr Med J* 2014;18 Suppl 1:15.
24 Onile OS, Awobode HO, Oladele VS, *et al*. Detection of urinary tract pathology in some Schistosoma haematobium infected Nigerian adults. *J Trop Med* 2016;2016:1–5.
25 Umar M, Umar U, Usman I, *et al*. Schistosoma haematobium infections: prevalence and morbidity indicators in communities around Wasai dam, Minjibir, Kano state, Northern Nigeria. *IJTDH* 2016;17:1–8.
26 Oyeyemi O, Ezekiel C, Ayeni K, *et al*. A pilot biomonitoring study of bladder tumor antigen (BTA) in aflatoxin exposed Nigerian villagers. *African Journal of Urology* 2018;24:152–6. doi:10.1016/j.afju.2018.02.003
27 Oyeyemi O, Adefalujo A, Ayeni K, *et al*. Urinary bladder thickness, tumor antigen, and lower urinary tract symptoms in a low Schistosoma haematobium-endemic rural community of Nigeria. *Urol Sci* 2018;29:151–5.
28 Onile OS, Calder B, Soares NC, *et al*. Quantitative label-free proteomic analysis of human urine to identify novel candidate protein biomarkers for schistosomiasis. *PLoS Negl Trop Dis* 2017;11:e0006045–21.
29 Muhammad AS, Mungadi IA, Darlington NN, *et al*. Effectiveness of bladder tumor antigen quantitative test in the diagnosis of bladder carcinoma in a Schistosoma endemic area. *Urol Ann* 2019;11:143. doi:10.4103/UA.UA_192_17
30 Sani A. Efficacy of urine cytology in the diagnosis of bladder cancer in Aminu Kano teaching hospital: comparison of cytology and histological findings. *West African College of Surgeons* 2018 https://mmed.mosuljournals.com/article_168295_46f99c0c57731e1b2a7218ef786deeb5.pdf
31 Ikuerowo SO, Ojewuyi OO, Bioku MJ, *et al*. Outcome of Mainz II pouch urinary diversion after radical cystectomy in patients with muscle-invasive bladder cancer: our experience. *Niger J Surg* 2018;24:12.
32 Shu'aibu S, Liman H, Akpayak I, *et al*. Preliminary experience with radical cystectomy and w-ileal pouch for muscle invasive transitional cell bladder carcinoma. *J West Afr Coll Surg* 2012;2:25–37.
33 Bakare SO, Adebayo AS, Awobode HO, *et al*. Arsenicosis in bladder pathology and schistosomiasis in Eggua, Nigeria. *Trans R Soc Trop Med Hyg* 2018;112:230–7.
34 Akinwale OP, Oliveira GC, Ajayi MB, *et al*. Squamous cell abnormalities in exfoliated cells from the urine of Schistosoma haematobium-infected adults in a rural fishing community in Nigeria. *World Health Popul* 2008;10:18–22.
35 Hodder SL, Mahmoud AA, Sorenson K, *et al*. Predisposition to urinary tract epithelial metaplasia in Schistosoma haematobium infection. *Am J Trop Med Hyg* 2000;63:133–8.
36 Manley KV, Hubbard R, Swallow D, *et al*. Risk factors for development of primary bladder squamous cell carcinoma. *Annals* 2017;99:155–60.
37 Cumberbatch MGK, Jubber I, Black PC, *et al*. Epidemiology of bladder cancer: a systematic review and contemporary update of risk factors in 2018. *Eur Urol* 2018;74:784–95. doi:10.1016/j.eururo.2018.09.001
38 Oyeyemi OT. Schistosomiasis control in Nigeria: moving round the circle? *Ann Glob Heal* 2020;86:1–3.
39 Salako O, Roberts AA, Isibor VI, *et al*. Innovative breast cancer awareness and advocacy campaign. *J Glob Oncol* 2017;3:169–76.
40 Ng K, Stenzl A, Sharma A, *et al*. Urinary biomarkers in bladder cancer: a review of the current landscape and future directions. *Urol Oncol* 2021;39:41–51. doi:10.1016/j.urolonc.2020.08.016
41 Ita OI, Akpayak IC, Onyedibe KI, *et al*. *Strongyloides stercoralis* larvae in the urine of a patient with transitional cell carcinoma of the bladder: a case report. *J Parasit Dis* 2019;43:154–7. doi:10.1007/s12639-018-1051-6

Search strategy for Ovid Gateway (Embase and Ovid)

Search terms used: Bladder cancer.mp AND nigeria.mp

We had no further filters or date restrictions in our search in order to cover as much content as possible.

JBI CRITICAL APPRAISAL CHECKLIST FOR ANALYTICAL CROSS SECTIONAL STUDIES

Reviewer B Russell Date June 2021

Author Ossai et al. Year 2014 Record Number 1

	Yes	No	Unclear	Not applicable
1. Were the criteria for inclusion in the sample clearly defined?	☐	☐	☐	☐
2. Were the study subjects and the setting described in detail?	☐	☐	☐	☐
3. Was the exposure measured in a valid and reliable way?	☐	☐	☐	☐
4. Were objective, standard criteria used for measurement of the condition?	☐	☐	☐	☐
5. Were confounding factors identified?	☐	☐	☐	☐
6. Were strategies to deal with confounding factors stated?	☐	☐	☐	☐
7. Were the outcomes measured in a valid and reliable way?	☐	☐	☐	☐
8. Was appropriate statistical analysis used?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

JBI Critical Appraisal Checklist for Case Series

Reviewer B Russell Date June 2021

Author Oyeyemi et al. Year 2018 Record Number 2

	Yes	No	Unclear	Not applicable
• Were there clear criteria for inclusion in the case series?	☐	☐	☐	☐
• Was the condition measured in a standard, reliable way for all participants included in the case series?	☐	☐	☐	☐
• Were valid methods used for identification of the condition for all participants included in the case series?	☐	☐	☐	☐
• Did the case series have consecutive inclusion of participants?	☐	☐	☐	☐
• Did the case series have complete inclusion of participants?	☐	☐	☐	☐
• Was there clear reporting of the demographics of the participants in the study?	☐	☐	☐	☐
• Was there clear reporting of clinical information of the participants?	☐	☐	☐	☐
• Were the outcomes or follow up results of cases clearly reported?	☐	☐	☐	☐
• Was there clear reporting of the presenting site(s)/clinic(s) demographic information?	☐	☐	☐	☐
• Was statistical analysis appropriate?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

JBI CRITICAL APPRAISAL CHECKLIST FOR ANALYTICAL CROSS SECTIONAL STUDIES

Reviewer B Russell Date June 2021

Author Bakare et al. Year 2018 Record Number 3

	Yes	No	Unclear	Not applicable
1. Were the criteria for inclusion in the sample clearly defined?	☐	☐	☐	☐
2. Were the study subjects and the setting described in detail?	☐	☐	☐	☐
3. Was the exposure measured in a valid and reliable way?	☐	☐	☐	☐
4. Were objective, standard criteria used for measurement of the condition?	☐	☐	☐	☐
5. Were confounding factors identified?	☐	☐	☐	☐
6. Were strategies to deal with confounding factors stated?	☐	☐	☐	☐
7. Were the outcomes measured in a valid and reliable way?	☐	☐	☐	☐
8. Was appropriate statistical analysis used?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

B Russell

JBI Critical Appraisal Checklist for Case Series

Reviewer_____ Date June 2021

Author Ochicha et al. Year 2003 Record Number 4

	Yes	No	Unclear	Not applicable
• Were there clear criteria for inclusion in the case series?	☐	☐	☐	☐
• Was the condition measured in a standard, reliable way for all participants included in the case series?	☐	☐	☐	☐
• Were valid methods used for identification of the condition for all participants included in the case series?	☐	☐	☐	☐
• Did the case series have consecutive inclusion of participants?	☐	☐	☐	☐
• Did the case series have complete inclusion of participants?	☐	☐	☐	☐
• Was there clear reporting of the demographics of the participants in the study?	☐	☐	☐	☐
• Was there clear reporting of clinical information of the participants?	☐	☐	☐	☐
• Were the outcomes or follow up results of cases clearly reported?	☐	☐	☐	☐
• Was there clear reporting of the presenting site(s)/clinic(s) demographic information?	☐	☐	☐	☐
• Was statistical analysis appropriate?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

B Russell

JBI Critical Appraisal Checklist for Case Series

Reviewer_____ Date June 2021

Author Aghaji and Mbonu Year 1988 Record Number 5

	Yes	No	Unclear	Not applicable
• Were there clear criteria for inclusion in the case series?	☐	☐	☐	☐
• Was the condition measured in a standard, reliable way for all participants included in the case series?	☐	☐	☐	☐
• Were valid methods used for identification of the condition for all participants included in the case series?	☐	☐	☐	☐
• Did the case series have consecutive inclusion of participants?	☐	☐	☐	☐
• Did the case series have complete inclusion of participants?	☐	☐	☐	☐
• Was there clear reporting of the demographics of the participants in the study?	☐	☐	☐	☐
• Was there clear reporting of clinical information of the participants?	☐	☐	☐	☐
• Were the outcomes or follow up results of cases clearly reported?	☐	☐	☐	☐
• Was there clear reporting of the presenting site(s)/clinic(s) demographic information?	☐	☐	☐	☐
• Was statistical analysis appropriate?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

JBI CRITICAL APPRAISAL CHECKLIST FOR ANALYTICAL CROSS SECTIONAL STUDIES

Reviewer B Russell Date June 2021

Author Onile et al. Year 2016 Record Number 6

	Yes	No	Unclear	Not applicable
1. Were the criteria for inclusion in the sample clearly defined?	☐	☐	☐	☐
2. Were the study subjects and the setting described in detail?	☐	☐	☐	☐
3. Was the exposure measured in a valid and reliable way?	☐	☐	☐	☐
4. Were objective, standard criteria used for measurement of the condition?	☐	☐	☐	☐
5. Were confounding factors identified?	☐	☐	☐	☐
6. Were strategies to deal with confounding factors stated?	☐	☐	☐	☐
7. Were the outcomes measured in a valid and reliable way?	☐	☐	☐	☐
8. Was appropriate statistical analysis used?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

JBI CRITICAL APPRAISAL CHECKLIST FOR ANALYTICAL CROSS SECTIONAL STUDIES

Reviewer B Russell Date June 2021

Author Muhammad et al. Year 2019 Record Number 7

	Yes	No	Unclear	Not applicable
1. Were the criteria for inclusion in the sample clearly defined?	☐	☐	☐	☐
2. Were the study subjects and the setting described in detail?	☐	☐	☐	☐
3. Was the exposure measured in a valid and reliable way?	☐	☐	☐	☐
4. Were objective, standard criteria used for measurement of the condition?	☐	☐	☐	☐
5. Were confounding factors identified?	☐	☐	☐	☐
6. Were strategies to deal with confounding factors stated?	☐	☐	☐	☐
7. Were the outcomes measured in a valid and reliable way?	☐	☐	☐	☐
8. Was appropriate statistical analysis used?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

JBI Critical Appraisal Checklist for Case Series

Reviewer B Russell Date June 2021

Author Takure et al. Year 2015 Record Number 8

	Yes	No	Unclear	Not applicable
• Were there clear criteria for inclusion in the case series?	☐	☐	☐	☐
• Was the condition measured in a standard, reliable way for all participants included in the case series?	☐	☐	☐	☐
• Were valid methods used for identification of the condition for all participants included in the case series?	☐	☐	☐	☐
• Did the case series have consecutive inclusion of participants?	☐	☐	☐	☐
• Did the case series have complete inclusion of participants?	☐	☐	☐	☐
• Was there clear reporting of the demographics of the participants in the study?	☐	☐	☐	☐
• Was there clear reporting of clinical information of the participants?	☐	☐	☐	☐
• Were the outcomes or follow up results of cases clearly reported?	☐	☐	☐	☐
• Was there clear reporting of the presenting site(s)/clinic(s) demographic information?	☐	☐	☐	☐
• Was statistical analysis appropriate?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

JBI CRITICAL APPRAISAL CHECKLIST FOR COHORT STUDIES

Reviewer B Russell Date June 2021

Author Ikuerowo et al. Year 2018 Record Number 9

	Yes	No	Unclear	Not applicable
1. Were the two groups similar and recruited from the same population?	☐	☐	☐	☐
2. Were the exposures measured similarly to assign people	☐	☐	☐	☐
3. to both exposed and unexposed groups?				
4. Was the exposure measured in a valid and reliable way?	☐	☐	☐	☐
5. Were confounding factors identified?	☐	☐	☐	☐
6. Were strategies to deal with confounding factors stated?	☐	☐	☐	☐
7. Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure)?	☐	☐	☐	☐
8. Were the outcomes measured in a valid and reliable way?	☐	☐	☐	☐
9. Was the follow up time reported and sufficient to be long enough for outcomes to occur?	☐	☐	☐	☐
10. Was follow up complete, and if not, were the reasons to loss to follow up described and explored?	☐	☐	☐	☐
11. Were strategies to address incomplete follow up utilized?	☐	☐	☐	☐
12. Was appropriate statistical analysis used?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

Whilst sufficient statistical analyses were used, the authors could have performed more sophisticated approaches such as logistic regression models.

JBI Critical Appraisal Checklist for Case Series

Reviewer B Russell Date June 2021

Author Shu'aibu et al. Year 2012 Record Number 10

	Yes	No	Unclear	Not applicable
• Were there clear criteria for inclusion in the case series?	☐	☐	☐	☐
• Was the condition measured in a standard, reliable way for all participants included in the case series?	☐	☐	☐	☐
• Were valid methods used for identification of the condition for all participants included in the case series?	☐	☐	☐	☐
• Did the case series have consecutive inclusion of participants?	☐	☐	☐	☐
• Did the case series have complete inclusion of participants?	☐	☐	☐	☐
• Was there clear reporting of the demographics of the participants in the study?	☐	☐	☐	☐
• Was there clear reporting of clinical information of the participants?	☐	☐	☐	☐
• Were the outcomes or follow up results of cases clearly reported?	☐	☐	☐	☐
• Was there clear reporting of the presenting site(s)/clinic(s) demographic information?	☐	☐	☐	☐
• Was statistical analysis appropriate?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

JBI Critical Appraisal Checklist for Case Series

Reviewer B Russell Date June 2021

Author Onile et al. Year 2017 Record Number 11

	Yes	No	Unclear	Not applicable
• Were there clear criteria for inclusion in the case series?	☐	☐	☐	☐
• Was the condition measured in a standard, reliable way for all participants included in the case series?	☐	☐	☐	☐
• Were valid methods used for identification of the condition for all participants included in the case series?	☐	☐	☐	☐
• Did the case series have consecutive inclusion of participants?	☐	☐	☐	☐
• Did the case series have complete inclusion of participants?	☐	☐	☐	☐
• Was there clear reporting of the demographics of the participants in the study?	☐	☐	☐	☐
• Was there clear reporting of clinical information of the participants?	☐	☐	☐	☐
• Were the outcomes or follow up results of cases clearly reported?	☐	☐	☐	☐
• Was there clear reporting of the presenting site(s)/clinic(s) demographic information?	☐	☐	☐	☐
• Was statistical analysis appropriate?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

JBI Critical Appraisal Checklist for Case Series

Reviewer B Russell Date June 2021

Author Akinwale et al. Year 2008 Record Number 12

	Yes	No	Unclear	Not applicable
• Were there clear criteria for inclusion in the case series?	☐	☐	☐	☐
• Was the condition measured in a standard, reliable way for all participants included in the case series?	☐	☐	☐	☐
• Were valid methods used for identification of the condition for all participants included in the case series?	☐	☐	☐	☐
• Did the case series have consecutive inclusion of participants?	☐	☐	☐	☐
• Did the case series have complete inclusion of participants?	☐	☐	☐	☐
• Was there clear reporting of the demographics of the participants in the study?	☐	☐	☐	☐
• Was there clear reporting of clinical information of the participants?	☐	☐	☐	☐
• Were the outcomes or follow up results of cases clearly reported?	☐	☐	☐	☐
• Was there clear reporting of the presenting site(s)/clinic(s) demographic information?	☐	☐	☐	☐
• Was statistical analysis appropriate?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

JBI CRITICAL APPRAISAL CHECKLIST FOR CASE REPORTS

Reviewer B Russell Date June 2021

Author Ita et al. Year 2019 Record Number 13

	Yes	No	Unclear	Not applicable
1. Were patient's demographic characteristics clearly described?	☐	☐	☐	☐
2. Was the patient's history clearly described and presented as a timeline?	☐	☐	☐	☐
3. Was the current clinical condition of the patient on presentation clearly described?	☐	☐	☐	☐
4. Were diagnostic tests or assessment methods and the results clearly described?	☐	☐	☐	☐
5. Was the intervention(s) or treatment procedure(s) clearly described?	☐	☐	☐	☐
6. Was the post-intervention clinical condition clearly described?	☐	☐	☐	☐
7. Were adverse events (harms) or unanticipated events identified and described?	☐	☐	☐	☐
8. Does the case report provide takeaway lessons?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

JBI Critical Appraisal Checklist for Case Series

Reviewer B Russell Date June 2021

Author Mungadi and Malami Year 2007 Record Number 14

	Yes	No	Unclear	Not applicable
• Were there clear criteria for inclusion in the case series?	☐	☐	☐	☐
• Was the condition measured in a standard, reliable way for all participants included in the case series?	☐	☐	☐	☐
• Were valid methods used for identification of the condition for all participants included in the case series?	☐	☐	☐	☐
• Did the case series have consecutive inclusion of participants?	☐	☐	☐	☐
• Did the case series have complete inclusion of participants?	☐	☐	☐	☐
• Was there clear reporting of the demographics of the participants in the study?	☐	☐	☐	☐
• Was there clear reporting of clinical information of the participants?	☐	☐	☐	☐
• Were the outcomes or follow up results of cases clearly reported?	☐	☐	☐	☐
• Was there clear reporting of the presenting site(s)/clinic(s) demographic information?	☐	☐	☐	☐
• Was statistical analysis appropriate?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

JBI CRITICAL APPRAISAL CHECKLIST FOR ANALYTICAL CROSS SECTIONAL STUDIES

Reviewer B Russell Date June 2021

Author Oyeyemi et al. Year 2018 Record Number 15

	Yes	No	Unclear	Not applicable
1. Were the criteria for inclusion in the sample clearly defined?	☐	☐	☐	☐
2. Were the study subjects and the setting described in detail?	☐	☐	☐	☐
3. Was the exposure measured in a valid and reliable way?	☐	☐	☐	☐
4. Were objective, standard criteria used for measurement of the condition?	☐	☐	☐	☐
5. Were confounding factors identified?	☐	☐	☐	☐
6. Were strategies to deal with confounding factors stated?	☐	☐	☐	☐
7. Were the outcomes measured in a valid and reliable way?	☐	☐	☐	☐
8. Was appropriate statistical analysis used?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

JBI CRITICAL APPRAISAL CHECKLIST FOR ANALYTICAL CROSS SECTIONAL STUDIES

Reviewer B Russell Date June 2021

Author Umar et al. Year 2016 Record Number 16

	Yes	No	Unclear	Not applicable
1. Were the criteria for inclusion in the sample clearly defined?	☐	☐	☐	☐
2. Were the study subjects and the setting described in detail?	☐	☐	☐	☐
3. Was the exposure measured in a valid and reliable way?	☐	☐	☐	☐
4. Were objective, standard criteria used for measurement of the condition?	☐	☐	☐	☐
5. Were confounding factors identified?	☐	☐	☐	☐
6. Were strategies to deal with confounding factors stated?	☐	☐	☐	☐
7. Were the outcomes measured in a valid and reliable way?	☐	☐	☐	☐
8. Was appropriate statistical analysis used?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

Supplementary Table 1. Summary of results

Study Ref	Article title	Authors and Year	Conclusion
1	Bacteriuria and urinary schistosomiasis in primary school children in rural communities in Enugu State, Nigeria	Ossai et al. 2012 [23]	The study concluded there was a high prevalence of bacteriuria co-infection among children with urinary schistosomiasis in Enugu State and recommended the need for concurrent antibiotics administration and follow-up to prevent later complications.
2	A pilot biomonitoring study of bladder tumor antigen (BTA) in aflatoxin exposed Nigerian villagers.	Oyeyemi et al. 2018 [26]	The authors concluded there may not be a correlation between BTA and aflatoxin
3	Arsenicosis in bladder pathology and schistosomiasis in Eggua, Nigeria.	Bakare et al. 2018 [33]	The authors found no association between arsenicosis and bladder arsenicosis. There was also no association between schistosomiasis associated-bladder pathology and arsenicosis.
4	Bladder cancer in Kano--a histopathological review.	Ochicha et al. 2003 [12]	Mean age 48.8 years. 53% of tumours were squamous and 35% TCC (two most common types). Over 75% of biopsies were taken from schistosomiasis endemic areas. Male to female ratio 5.1:1.
5	Bladder tumours in Enugu, Nigeria	Aghaji et al. 1988 [20]	The results support a strong association between schistosomiasis and bladder cancer. 56% TCC, 38.8% SCC
6	Detection of urinary tract pathology in some schistosoma haematobium infected Nigerian adults.	Onile et al. 2016 [24]	There is evidence that S. haematobium infections may be associated with bladder pathology, on ultrasound examination. Individuals with bladder pathologies could have heavy or light intensity of schistosomiasis infection or have no existing infection at all. However, a long term exposure to schistosomiasis is necessary for the development of bladder cancer.
7	Effectiveness of bladder tumor antigen quantitative test in the diagnosis of bladder carcinoma in a schistosoma endemic area.	Muhammad et al. 2019 [29]	The authors concluded that BTA TRAK is more sensitive but poorly specific as compared to that of the urine cytology for bladder cell carcinoma detection in a schistosoma endemic area.
8	Histopathologic Pattern of Bladder Cancers in Ibadan Southwest Nigeria: An Update.	Takure et al. 2015 [14]	The authors concluded that urothelial carcinoma was the predominant type of bladder cancer in Ibadan. Both urothelial and squamous cell carcinomas occur earlier in women.
9	Outcome of Mainz II Pouch Urinary Diversion after Radical Cystectomy in Patients with Muscle-invasive Bladder Cancer: Our Experience.	Ikuerowo et al. 2018 [31]	The authors concluded that Mainz II pouch urinary diversion is safe and acceptable to most of our patients with good long-term results.
10	Preliminary experience with radical cystectomy and w-ileal pouch for muscle invasive transitional cell bladder carcinoma.	Shu'aibu et al. 2012 [32]	Study is small but highlights the challenges of surgical management of patients with muscle invasive transitional cell carcinoma of the urinary bladder in a resource-constrained setting.
11	Quantitative label-free proteomic analysis of human urine to identify novel candidate protein biomarkers for schistosomiasis.	Onile et al. 2017 [28]	This study demonstrates that urinary proteomics is a viable approach to discovering candidate biomarkers for schistosomiasis and its associated pathology, but the results presented here require validation in a larger cohort before clinical applications can be considered.

12	Squamous cell abnormalities in exfoliated cells from the urine of Schistosoma haematobium-infected adults in a rural fishing community in Nigeria.	Akinwale et al. 2008 [34]	Our results showed an association between urinary tract hyperplasia and S. haematobium infection
13	Strongyloides stercoralis larvae in the urine of a patient with transitional cell carcinoma of the bladder: a case report.	Ita et al. 2019[41]	This case report highlights the need for physicians working in areas that are endemic for S. stercoralis to investigate immunocompromised patients for S. stercoralis infection given the poor prognosis of disseminated infection in this group of patients.
14	Urinary bladder cancer and schistosomiasis in North-Western Nigeria.	Mungadi and Malami 2007 [13]	The association with chronic urinary schistosomiasis and bladder cancer is very strong and the hospital incidence appears to be rising.
15	Urinary bladder thickness, tumor antigen, and lower urinary tract symptoms in a low Schistosoma haematobium-endemic rural community of Nigeria.	Oyeyemi et al. 2018 [27]	The study concluded that high occurrence of BTA and BWT in the individuals indicates high risk of urothelial carcinoma and urinary bladder irritation, respectively. Combination of BWT and other self-reported LUTS could moderately diagnose BTA in urine.
16	Schistosoma haematobium Infections: Prevalence and Morbidity Indicators in Communities around Wasai Dam, Minjibir, Kano State, Northern Nigeria	Umar et al. 2016 [25]	The study concluded that the proximity of the communities to the Dam portends continuous unprotected exposure to the cercariae-infested water by individuals for various purposes, hence continuous manifestation of morbidity indicators because of recurrent infections.
17	Bladder Cancer Burden and Challenges of Management in Kano, North Western Nigeria	Yunusa et al. 2016 [22]	Squamous cell carcinoma is still the predominant histological subtype of bladder cancer in our environment owing to endemicity of schistosomiasis and usually present in advanced stage.
18	Efficacy of Urine Cytology in the Diagnosis of Bladder Cancer in Aminu Kano Teaching Hospital: Comparison of Cytology and Histological Findings	Dr Auwal Sani 2018 [30]	Based on the findings from this study, Urine cytology is an effective method for evaluation of patients presenting with features suggestive of bladder cancer. Routine use of urine cytology as the initial test for evaluating patient with suspected bladder cancer is recommended.
19	Changing Trends of Transitional Cell Carcinoma of the Bladder in Ile-Ife	Salako et al. 2019 [21]	TCC is rising in proportion amongst other types of bladder cancer. It is the commonest bladder cancer seen associated with cigarette smoking and industrial exposure to carcinogens.