

HealthCare Access Barrier (HCAB) framework for the barriers to cancer care during conflicts: perspective from Iraq

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ABSTRACT

The Iraqi population has lived under four decades of conflicts, warfare and political instability. The health consequences of the protracted conflict continue to persist. This work critically analyses Iraq's barriers to delivering and accessing cancer care during the conflicts that Iraq passed through from 1980 to 2017. To identify the barriers to accessing and delivering cancer care services, we used the HealthCare Access Barriers framework, which categorises the barriers into three groups: financial, structural and cognitive. Moreover, a structured search was performed in multidisciplinary databases. To produce a comprehensive body of literature, further materials were retrieved using alternative methods, such as hand-searching and snowballing. The key findings and themes identified in the literature were issues related to funding and affordability (within the financial), destruction and inaccessibility of facilities, therapeutic and diagnostic shortages, workforce and human resources and lack of national guidelines and awareness programmes (within the structural), awareness and knowledge and finally attitudes and beliefs (within the cognitive). These results demonstrated that the barriers to cancer care delivery are complex and inter-related. The financial and structural barriers were particularly intertwined with the protracted conflict, but this relationship was not demonstrable within the findings of the cognitive barriers. We concluded that the barriers facing the delivery and access to cancer care in Iraq are intertwined mainly with its protracted conflict. To ensure that future generations do not continue to pay the price of war, improved reconstructive efforts and further research are necessary.

INTRODUCTION

Visiting the cancer centre in Iraq is a harrowing experience. Requested radiotherapy equipment, chemotherapy drugs and analgesics are consistently blocked by United States and British advisers. Stopping cancer treatment will not topple a dictatorship, it will serve only to consolidate a background of hatred in a new generation who will never forget the scars.¹

Twenty-four years have passed since the above report on cancer services in Iraq, yet conflict and cancer remain two terms inextricably

linked with Iraq's history. Although during the 1970s and 1980s, Iraq's healthcare system was termed the best in the Arab world with respect to its infrastructure and free health coverage.² After 40 years of successive conflicts, this no longer holds true; the prolonged humanitarian crises significantly hampered the capacity of Iraq's health system due to a combination of decreased health expenditure, loss of medical personnel and the targeted destruction of health facilities.³ From 1980 to 2017 ([table 1](#)), the Iraqi population lived under wars, embargo, sanctions and invasions, during which countless lives were lost, healthcare facilities were destroyed and potentially carcinogenic weaponry was deployed.⁴ In the aftermath of the consecutive wars and conflicts, a legacy of excess cancer morbidity and mortality was left behind.⁵

Today, healthcare in Iraq is still provided free of charge through a network of public hospitals and primary healthcare centres (PHCC) organised by the Ministry of Health (MoH).⁶ According to the MoH's latest annual statistical report, Iraq has 295 governmental hospitals, 155 private hospitals and 2805 PHCC.⁷ The ratio of hospital beds per 1000 population is 1.2; this is the lowest of all the countries bordering Iraq, including Iran and Syria.⁸ There is no formal health insurance scheme in Iraq; therefore, private healthcare is financed by out-of-pocket payments, making it unaffordable for many of the Iraqi population.⁶ Iraq's economy has continued its recovery in recent years. Real gross domestic product (GDP) growth accelerated to 7.0% and per capita GDP growth increased to 5.4% in 2022.⁹ Iraq's rapid population growth (2.4% per annum)⁹ highlights a need for higher growth to improve welfare outcomes and to close the growing income gap with peers. The population in Iraq in 2023 is estimated to be 44 million.¹⁰

In light of the above, this work provides a structured analysis of the barriers facing the



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Table 1 A summary of Iraq's major conflicts

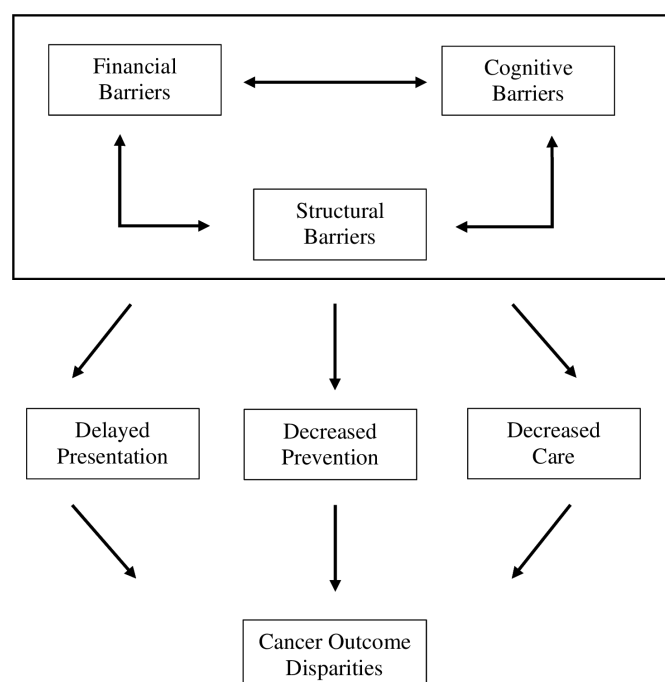
Year	Conflict
1980–1988	Iran-Iraq war
1990–1991	Kuwait-Iraq 'Gulf' war
1990–2003	UN sanctions and embargo
2003–2011	US-Iraq war and volatile security
2014–2017	ISIS-Iraq war
ISIS, Islamic State of Iraq and Syria; UN, United Nations.	

delivery of and access to cancer care in Iraq, demonstrated within the context of its protracted conflict. The topic for this review was developed in response to a gap in the literature. The literature regarding cancer care in Iraq or war-torn nations often describes the services instead of critiquing the barriers to their delivery and uptake.¹¹ Thus, the aims of this work are twofold:

1. To understand the barriers to delivering and accessing cancer care in Iraq following its years of protracted conflict, using the HealthCare Access Barrier (HCAB) framework.
2. To suggest recommendations based on the findings to ameliorate the identified barriers.

METHODS

This is a scoping review; the methodology has been derived from Levac *et al.*, who adapted the framework of Arksey and O'Malley for scoping reviews.^{12 13} The HCAB model¹⁴ (figure 1) identifies three fundamental categories that hinder healthcare access: financial, structural and cognitive barriers. This model will be used in this literature review to support the analysis of the results

**Figure 1** The HealthCare Access Barrier model.

and to highlight the barriers to accessing and delivering cancer care in Iraq.

The search strategy displayed in the online supplemental file 1 was undertaken using the multidisciplinary databases Scopus, Web of Science and Medline. Additional pieces of literature were retrieved using alternative methods, such as manual searching and snowballing. Online supplemental file 2 shows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses diagram of our literature as of 6 March 2023.

Studies based on the Middle East or Eastern Mediterranean region were included if Iraq was discussed within them. The exclusion criteria were decided based on the relevance of the literature to the objectives and, therefore, their ability to answer the overarching research question. Articles were not excluded based on publication date, as the conflict in Iraq has been going on for many decades. The exclusion criteria were studies not addressing the Iraqi population nor any part of the HCAB model and those that focused on Iraqi refugees, war veterans, the aetiology of cancer or the mechanisms of treatments. Online supplemental file 3 summarises the reviewed literature in this work.

RESULTS

The findings have been summarised within the categories of the HCAB model. Several themes were identified; these have been used to subdivide the categories further to demonstrate the key overarching findings.

Financial barriers

Funding

Following Iraq's protracted conflict, government health expenditure decreased significantly to accommodate the increase in military spending.^{15 16} The effects of this were compounded by economic sanctions on Iraq, which enhanced the shortage of drugs and equipment and further reduced the capacity of cancer care infrastructures.^{17 18} Furthermore, Iraq's government has not allocated a specific fund for cancer services in Iraq; thus, the deficiency of cancer services and specialised healthcare professionals in Iraq fails to be addressed.¹⁶ Overall, the delivery of cancer care in Iraq is hindered by a deficiency in government funding due to healthcare not being a priority within the political agenda.¹⁹

Affordability

There are direct and indirect costs associated with cancer care. Direct costs relate to private investigations and treatments, whereas indirect costs can accumulate due to travel expenses, loss of wages and extended hospital stays.²⁰ Although Iraq offers free healthcare, the availability of these services has been severely reduced due to the protracted conflict, thus pushing some families towards seeking cancer care in private hospitals.¹⁷ Since Iraq has no private health insurance schemes, out-of-pocket costs significantly burden less affluent Iraqis.^{21 22}

Financial barriers contributed to the delayed presentation, workup and treatment of childhood cancers.²¹

The violent occupation of Mosul by the Islamic State of Iraq and Syria (ISIS) led to the destruction of many hospitals, preventing residents from accessing local care facilities.¹⁵ The services are unevenly dispersed across Iraq and are mainly concentrated in Baghdad, Basra, Karbala, Erbil and Najaf; residents from Mosul and other provinces depend on transportation to reach cancer services.¹⁵ As the transport costs accumulate, patients increasingly face financial barriers in accessing timely cancer care.^{15 21} Advanced cancer services are also increasingly moving towards the private sector, further limiting the affordability of cancer care.¹⁵ These deficiencies have also necessitated an increase in cross-border care.^{15 23} This creates a substantial financial burden for patients and their carers, who must fund their treatment, travel, accommodation and food expenses. Ninety per cent of the cross-border patients experienced 'financial toxicity' and 'financial distress' as around a third sold their possessions, even homes, to cover the travel and treatment expenses.²³

Structural barriers

Structural barriers were highly cited as barriers to the delivery and access to cancer care and were especially related to the protracted conflict. The following four key themes were identified:

1. *Destruction and inaccessibility of facilities*: the targeted destruction and looting of healthcare facilities and laboratories has been a common challenge throughout Iraq's protracted conflict; 12% of Iraq's hospitals were destroyed following the Gulf War, with a further proportion damaged during Iraq's occupation by ISIS.^{7 23} Many hospitals ended up with inadequate water, sewage and electricity systems, compromising the delivery of safe and effective healthcare; moreover, support services operate below capacity, including the laboratory and pharmacy, limiting the accuracy of patient diagnoses.²⁰ Furthermore, although many patients are lost to follow-up, hospitals lack a system to detect and contact patients who dropped out of treatment.²⁰ For many patients, dropping out was directly related to the conflict, where patients from a distance faced security-related travel difficulties, which hindered them from continuing treatment, thus worsening treatment outcomes.^{18 20 23}
2. *Therapeutic and diagnostic shortages*: the United Nations's 13-year economic sanctions hampered Iraq's diagnostic and therapeutic capacity. They placed restrictions on the import of any materials considered to have the potential of being manufactured into weapons of mass destruction, including key cancer treatments and equipment such as linear accelerators and nuclear diagnostics, which ultimately made Iraq one of the most poorly resourced Arab countries in terms of its nuclear medicine and imaging services.^{15 17 18} The resultant lack of radiotherapy machines has also had

implications for geriatric radiotherapy; it has increased waiting times and caused many patients who live long distances from treatment centres to refuse treatment.²⁴

There has been slow progress in the availability of radiotherapy machines, moving from 4 in 2002, to 6 in 2012 and then 34 by the end of 2022.^{11 25 26} Still, this number is inadequate and covers around 42.5% of the Iraqi population's needs (two machines per million population).^{25 26} Palliative care services, seen as a luxury rather than a necessity, are primitive till now, with no structured programme or guidelines.^{20 27 28} Additionally, a study assessing the availability of opioids for cancer pain in the Middle East found Iraq to have the most limited formulary within the region; codeine and injectable morphine were the only available opioids, and these could only be administered to inpatients and only by those with a special authorisation.^{28 29}

3. *Workforce and human resources*: since the start of Iraq's conflict, doctors and healthcare workers have been victims of kidnappings, death threats and violent abuse; around 320 doctors are estimated to have been killed since the 2003 US invasion.¹⁶ Iraq has, therefore, seen a mass exodus of its doctors, with an estimated brain drain of 20 000 doctors since the 1990s.¹⁶ This creates barriers to delivering cancer care, as the remaining few cancer physicians and allied healthcare professionals are overworked and under-resourced, with a hampered capacity to deliver effective care.^{20 23} In 2017, it was reported that of 11 585 specialist physicians, only 52 and 76 were clinical or radiation oncologists, respectively, comprising around 3–4 oncologists per million of the population.¹⁹ This is significantly lower than the recommended 8–12 oncologists per million population, meaning at least 350 more oncologists are required to adequately meet the population's needs.¹⁹

The shortage of specialised physicians and healthcare workers can be attributed to the lack of training programmes. It acts as a barrier to safe practice, causing some healthcare workers to seek alternative means, such as observing experienced colleagues or watching YouTube videos, to overcome this.^{30 31} A descriptive study of Iraq's first radiation oncology certification board programme (2013–2017) indicated that previous attempts in the late 1980s and early 2003 failed to materialise due to the wars.³² Before launching the programme in 2013, the founders identified many conflict-related barriers hindering implementation, including the lack of board-certified trainers, training centres and equipment. During the programme's establishment, additional barriers were faced, such as a lack of financial support, decreased salaries due to heightened terrorist activity in nearby regions and delays in repairing treatment machines. Despite this, nine physicians completed the programme, demonstrating the benefits of investing in personnel.

4. *Lack of national guidelines and awareness programmes*: despite the presence of early detection clinics, until now, there are no nationwide cancer screening programmes

for asymptomatic people in Iraq^{31 33}; women attend a screening at the request of a physician or their discretion.³⁴ The motives of women attending a Breast Cancer Early Detection (BCED) clinic in Baghdad showed that most women were symptomatic, with only 8.4% having attended the clinic for proper screening purposes.³⁴ The majority of women were self-referred (43%), with the rest either having been recommended by a friend or family member registered at the clinic (31%) or by their private physician (26%). Women with a positive family history or high socioeconomic status were 5.1 and 2.7 times more likely to request breast cancer screening, respectively. This highlighted the inequitable access to screening without a national breast screening programme.

The lack of public awareness programmes is a structural barrier which gives rise to cognitive barriers. Al-Gburi and Alwan found that 52.8% of Iraqi patients with breast cancer had never experienced breast self-examination (BSE); this lack of awareness and the subsequent delay in cancer diagnosis was attributed to the lack of national awareness and education program.³⁵ Al-Qazaz *et al* reported similar results; 26% of the interviewed females performed BSE routinely; however, only 16.4% were correct in answering how BSE should be performed.³⁶ Similarly, Rasul *et al* cite the lack of public information programmes and official reminder systems as barriers to the uptake of cervical cancer screening among Iraqi Kurdish women.³⁷

Several studies criticised the lack of national practice guidelines for cancer care in Iraq. Basbous *et al* and Zeinah *et al* cited this as a barrier to delivering paediatric cancer care and palliative care, respectively; however, neither elaborated on this within their studies.^{21 27} Maallah *et al* detail that although guidelines for implementing a BCED programme have been established in Iraq, they have yet to be implemented nationally.¹⁶ Furthermore, there is nothing in place to monitor nor evaluate the implementation of such a programme.¹⁶ Similarly, Alwan and Kerr and Basbous *et al* attribute patients' late-stage presentation to inadequate referral systems, lack of oncologists and paucity of national guideline.^{17 21}

Cognitive barriers

The literature did not correlate the cognitive barriers with the ongoing conflict frankly. Still, these can be broadly divided into two key themes.

Awareness and knowledge

1. **Breast cancer:** several studies assessed the knowledge and awareness of breast cancer and BSE among Iraqi women.^{36 38–41} Al Alwan *et al* found that most of their participants refused to undergo screening if they had no complaints.³⁸ In the study by Ali *et al*, 84% of the participants had poor knowledge of breast cancer, with <50% being able to recognise the symptoms.³⁹ Furthermore, although 60% of the women in the study

had heard of BSE, 32% of women did not know how to perform it.³⁹ Collectively, the results of these studies demonstrate extensive insufficiencies in the knowledge of breast cancer and the purpose of screening practices among Iraqi women, which, therefore, create barriers to their access to timely care.

2. **Cervical cancer:** there is a noticeable gap in knowledge, attitude and practice regarding cervical cancer screening services in Iraq.^{42 43} Many women had not heard of pap tests and emphasised the role of doctors in promoting screening, with some suggesting they should talk about the test's purpose on TV.^{42 43} Some believed smear tests to be only for 'unhealthy women' or that they test for infection or pregnancy.⁴³ The major barriers to women having a pap smear are thus a lack of knowledge and a lack of request by the physician; the latter was reported as a barrier by 100% of the women who did not practice pap smears, hence reiterating the role of the doctor in promoting pap smears.^{42 43}
3. **Attitudes and beliefs:** fear was also a barrier to the screening and early diagnosis of cancer. For some, fear of a positive screening result or a cancer diagnosis was due to the association between cancer and death.³⁷ For others, the stigma and shame associated with a cancer diagnosis contributed to their late-stage presentation.^{17 31} The implications of these beliefs have been demonstrated in some reports that 12%–22% of women did not practice BSE due to fear of discovering a tumour.^{40 41} Another theme was fear relating to the tests, with some women fearing that the pap tests may be painful or uncomfortable or that the equipment used would not be sterile.³⁷ The influence of cultural and religious beliefs has also been discussed as a barrier to cancer care delivery; they were found to hinder mammography uptake and clinical breast examinations if performed by the opposite sex.¹⁶ Cultural stigma has also been found to prevent women from seeking care for gynaecological symptoms, resulting in delayed presentations and a reduced pap smear.⁴³

DISCUSSION

This review identified several barriers to delivering and accessing cancer care in Iraq (figure 2). The use of the HCAB framework provided a method to analyse the barriers, allowing the first objective of this work to be achieved. The key themes within the financial barriers category were barriers relating to the insufficient funding of services and the limited affordability of indirect treatment costs. These were interrelated with the destruction of facilities during the conflicts, coupled with inadequate funding from the government, which has led to a scarcity of cancer services. Consequently, patients are forced to travel far to reach services, and as the transportation costs accumulate, this creates a financial burden for less affluent Iraqis.

The structural barriers category demonstrated the role of conflict in exacerbating and producing the

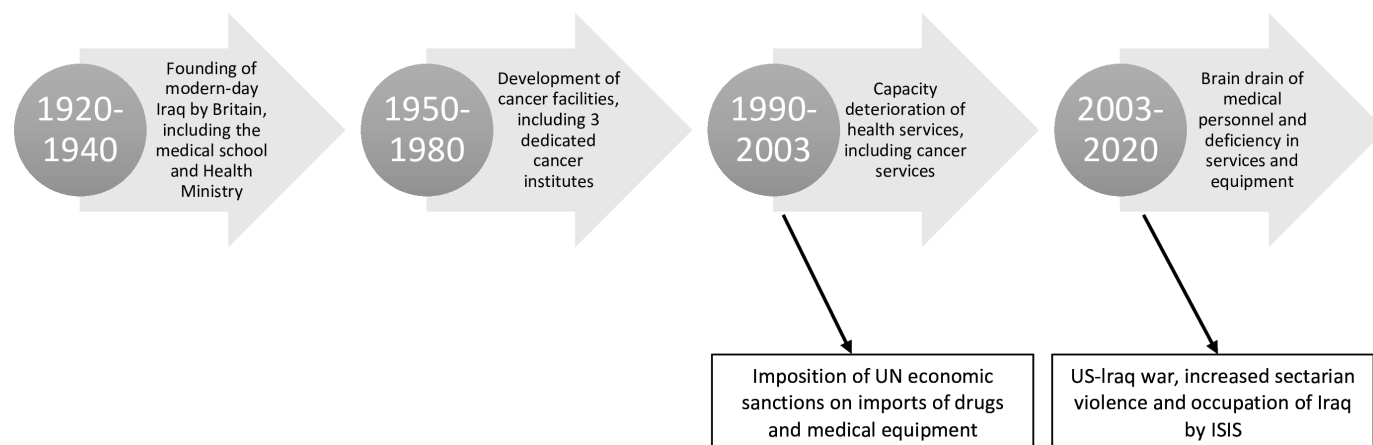


Figure 2 Conflict and oncology in Iraq. ISIS, Islamic State of Iraq and Syria; UN, United Nations.

barriers relating to cancer care in Iraq. It identified four key themes: the destruction and inaccessibility of facilities, therapeutic and diagnostic shortages, workforce and human resources and a lack of national guidelines and awareness programmes. Similar barriers have been reported in the literature assessing cancer care in Afghanistan. Afghanistan is a particularly relevant comparator as it has faced similar protracted conflict, including a US-led invasion in 2001 where depleted uranium was also used.⁴⁴ The delayed presentation of Afghani patients with cancer has been attributed to conflict-related factors such as the lack of surveillance programmes, knowledge of cancer treatments and access to treatments,⁴⁵ reiterating the findings of this review. Khan *et al* also cited similar barriers to the delivery of breast cancer care in Afghanistan as those identified by Maallah *et al*, such as low health literacy, insufficient health infrastructures and inadequate treatment resources.^{16 46} There is, therefore, a consistency within the literature regarding the role of conflict in diminishing the quality of cancer care in conflict situations.

Although the aim of this review was not to demonstrate the impact of the conflict on Iraq's cancer care, it is critical to note that due to the prolonged nature of Iraq's conflicts, it is difficult to assess the extent to which some of the difficulties have arisen since the conflicts began. The conflict has been ongoing since 1980; this was a different era for cancer care globally, and there is a lack of literature describing Iraq's cancer care before this period. In some cases, it was clear that the conflict hampered the progression of Iraq's cancer services, for example, by causing nuclear medicine training programmes to be halted in 1996.¹⁵ However, in other cases, such as Iraq's lack of national screening programmes,²⁴ it is difficult to separate the effects of the conflict from pre-existing factors. For example, national cervical screening programmes were not introduced in the UK until 1988 and still do not exist in Saudi Arabia and Bahrain.^{47–49} The latter two countries have been chosen for comparison as they have not faced protracted conflict. Yet, they share a commonality with Iraq: all Arab countries in the

Arabic Gulf with a Muslim majority. As such, there may be confounding factors besides the conflict, such as the influence of culture, which have prevented advancements in Iraq's cancer care capacity.

Regarding the cancer care continuum,⁵⁰ the findings of this review have revealed that the prevention and early detection of cancer in Iraq are hindered by structural barriers such as the lack of guidelines, national screening programmes and vaccination programmes. Prevention is a crucial aspect of cancer control and is achieved by factors such as tobacco control, physical activity and vaccinations.⁵⁰ Studies were deficient within this review on the barriers to implementing the aforementioned factors, hence necessitating further research. Finally, this review found that a palliative care programme in Iraq has not yet been established, as echoed within Syria and Afghanistan.^{51 52} Without this, the cancer care continuum fails to be wholly addressed within Iraq, but further research is necessary to understand the reasons for and implications of its absence.

Recommendations

A key aim of this review was to suggest recommendations to ameliorate the identified barriers to the access and delivery of cancer care in Iraq. Although the feasibility remains unknown due to the scarcity of literature, the following recommendations (summarised in [table 2](#)), based on common themes within the literature, are suggested.

Overcoming financial barriers

1. The decrease in government health expenditure secondary to the protracted conflict has exacerbated and contributed to the scarcity of cancer services in Iraq.^{15 16} Therefore, a need for an increase in the allocation of funds towards cancer services is clear, despite the feasibility of this requiring further research.
2. The scarcity of services has forced patients to seek cross-border cancer care or travel far distances within and between provinces to reach services, both of which create a financial burden due to the accumulation of

Table 2 List of recommendations

HCAB model	Recommendations
Financial barriers	<ul style="list-style-type: none"> ► Increase the allocation of funding and investment in cancer services. ► Compensate patients for transportation costs if referred to distant cancer centres.
Structural barriers	<ul style="list-style-type: none"> ► Prioritise training programmes and service implementation, particularly relating to screening programmes, early detection and palliative care. ► Establish a tertiary comprehensive national cancer institute/s.
Cognitive barriers	<ul style="list-style-type: none"> ► Promote awareness of cancer symptoms and services through a public health education programme, using media sources such as TV and mobile phones.
HCAB, HealthCare Access Barriers.	

the indirect costs of cancer care. Therefore, it is imperative to organise financial compensation for patients travelling to distant cancer centres, although again, this feasibility requires further research.

Overcoming structural barriers

1. This review demonstrated that the insufficient knowledge and availability of healthcare workers in Iraq is primarily due to the lack of training programmes. Mula-Hussain *et al* outlined the challenges, solutions and outcomes of implementing a specialty training programme in radiation oncology in Iraq³²; their findings provide vital insights that may support implementing other training programmes. This is especially important in palliative care, as this specialty is lacking in Iraq.

Table 3 Summary of areas for future research

HCAB model	Priorities for future research
Financial barriers	<ul style="list-style-type: none"> ► The cost of private cancer care in Iraq and the implications of this for the accessibility to private cancer services. ► The indirect costs of cancer care in Iraq, such as travelling between provinces for cancer services.
Structural barriers	<ul style="list-style-type: none"> ► The extent to which reconstruction of destroyed cancer facilities has been achieved. ► The barriers to the implementation of oncology training programmes and national screening services. ► The implications of the identified structural barriers, such as the lack of a palliative care programme, on cancer outcomes.
Cognitive barriers	<ul style="list-style-type: none"> ► The role of public education programmes in increasing the uptake of cancer services. ► The relationship between the identified cognitive barriers and the protracted conflict in Iraq.
HCAB, HealthCare Access Barriers.	

2. Additionally, a key finding by Maallah *et al* of the barriers impeding the early detection of breast cancer in Iraq was the poor implementation of national protocol guidelines.¹⁶ As they suggested, overcoming this can be achieved by monitoring the programmes through quality assessment programmes and integrating findings relating to the availability of screening resources within the MoH annual statistics report.

Overcoming cognitive barriers

Cognitive barriers highlight the role of patients and healthcare providers in facilitating access to, and delivery of, effective and timely care.¹⁴ Addressing these barriers is complex and multifaceted. It must be centred on a culturally sensitive approach, particularly when aiming to increase the uptake of cervical smears due to the cultural stigma associated with seeking care for gynaecological symptoms.³¹ Many of the identified cognitive barriers were inter-related with the structural barriers. For example, the knowledge deficits of healthcare workers relating to the practice of cervical smears can be attributable to the lack of training programmes. As such, improving and implementing training programmes for doctors and allied healthcare professionals is imperative. Maallah *et al* emphasised the importance of increasing public awareness and the role of media in achieving this.¹⁶ In the study by Ali *et al*, some participants suggested using the TV to promote screening services.⁴³ Between 2015 and 2016, it was reported that up to 97.3% of Iraqi households had satellite TV, and 90.9% of adults had a mobile phone.⁵³ As such, public awareness campaigns delivered through these media sources provide a low-cost solution with the potential to reach large proportions of the population.

Limitations

Limitations of our work are mainly due to the scarcity of literature, particularly regarding the financial and cognitive barriers to delivering and accessing cancer care. Furthermore, many of the retrieved studies focused on breast and cervical cancers; thus, it is likely that patients with complex and multidisciplinary tumours face challenges which have not been identified within this review. There was also a deficiency of studies relating to surgical oncology in Iraq. As such, [table 3](#), although not exhaustive, summarises potential areas for further research within the categories of the HCAB model.

CONCLUSION

This literature review aimed to address gaps in the literature; this was successfully achieved by identifying the financial, structural and cognitive barriers to the delivery and access to cancer care in Iraq in the context of its protracted conflict. There was an interplay between the categories of the HCAB model. Except for the cognitive barriers category, the role of the conflict in exacerbating and producing these barriers has been demonstrable. There were discrepancies in the availability of literature

on the different aspects of the HCAB model and the cancer care continuum, suggesting differences in the perceived importance of the issues and the ability to conduct research relating to them. Since the scarcity of literature limited this review, there is a need for further research. Conflict and cancer have unfortunately become embedded within Iraq's history due to the long-term neglect of the health of the Iraqi population. Future generations must not continue to pay the price of Iraq's wars. This review has identified actionable and modifiable barriers; thus, there remains hope for improving Iraq's oncology services and the health of the Iraqi population.

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Contributors This manuscript was based on an iBSc Global Health dissertation submitted to the Institute of Global Health at the University College London on 28 April 2023. The work was written by KM (including idea conception, study design, research planning, literature acquisition, results' analysis, findings' interpretation and writing of the thesis and the manuscript), with LM-H's help (in findings' interpretation, critical analysis, reviewing and editing and being the corresponding author of this manuscript) and RG's supervision (in findings' interpretation, critical analysis, reviewing and editing and being the senior author of this manuscript).

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