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## Bibliometric analysis of research on the effects of human immunodeficiency virus in orthopaedic and trauma surgery

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### Abstract

#### BACKGROUND

There is little research investigating how human immunodeficiency virus (HIV) affects outcomes in orthopaedic surgery. With advances in treatment, HIV has become a chronic health problem and the chance of orthopaedic surgeons encountering it in clinical practice is increasing.

#### AIM

To ascertain the quantity and quality of peer-reviewed publications in orthopaedic journals about HIV.

#### METHODS

A search of the Web of Science database was carried out, identifying any articles relating to HIV published in orthopaedic journals. These were assessed for geographic origin and level of evidence.

#### RESULTS

Of 48.7% of orthopaedic journals listed on the Web of Science database had

**Specialty type:** Orthopedics**Country/Territory of origin:** South Africa**Peer-review report's scientific quality classification**

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Grade B (Very good): 0

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published articles relating to HIV. There were 168 articles about HIV in orthopaedic journals with only 40.5% ( $n = 68$ ) published in the time frame we analysed (January 2007 to September 2017). Very few articles came from low-income countries and any articles published from that setting were collaborations. All of the articles were low level of evidence.

**CONCLUSION**

There is a need for more high level orthopaedic and trauma research investigating the effects of HIV, particularly research from low-income countries, where higher level research will help to guide improvements in their treatment of its musculoskeletal manifestations and complications.

**Key Words:** Human immunodeficiency virus; Research; Bibliometric analysis; Analysis; Orthopaedic

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**Core Tip:** This paper looks in to the research being carried out in orthopaedic journals regarding human immunodeficiency virus and how it affects outcomes in orthopaedic and trauma surgery. We have shown that there is a significant lack of research in to this subject despite the fact there is a high prevalence of the disease in the setting which has the greatest burden of disease from trauma. Our findings highlight the need for further research to improve outcomes in trauma and orthopaedic surgery in these settings.

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**INTRODUCTION**

The World Health Organization in 2018 estimated that there are 37.9 million people globally living with human immunodeficiency virus (HIV), with well over half of these people (25.7 million, 69.8%) living in sub-Saharan Africa<sup>[1]</sup>.

The introduction of antiretroviral therapy (ART) in 1997 has altered the course and nature of patients infected with HIV by increasing the duration of asymptomatic infection and, consequently, patients with HIV are attaining close to normal life spans<sup>[2]</sup>. Because individuals are now living longer, they commonly present with complications that result from the virus directly or the ART used to treat it<sup>[3]</sup>.

HIV can present with a number of different orthopaedic pathologies, including osteonecrosis of the hip or knee, osteoporosis, septic arthritis and primary HIV arthropathy<sup>[4]</sup>. Furthermore, ART treatment is also associated with osteonecrosis and increase in risk of osteoporosis, potentially resulting in increased risk of sustaining a fracture<sup>[5,6]</sup>. With the increasing availability of ART and the major decline in HIV-related mortality levels<sup>[7]</sup>, orthopaedic surgeons are more likely to encounter patients with HIV in their surgical practice. This is particularly relevant for orthopaedic surgeons operating in sub-Saharan Africa and in low-income countries (LIC), where HIV is more prevalent<sup>[1]</sup>.

In the current orthopaedic literature, there has been little research investigating the effects of HIV on outcomes in orthopaedic surgery<sup>[8]</sup>. We found in a previous study that, despite a significant proportion of the global burden of disease from musculoskeletal disease and trauma occurring in LIC, there was little musculoskeletal disease and trauma research being produced in that setting<sup>[9]</sup>. Similarly, LIC have a much higher prevalence of HIV<sup>[1]</sup> but the current literature would suggest that orthopaedic research into how HIV may impact outcomes in musculoskeletal disease and trauma, is being conducted outside of the setting where it is most needed.

The aim of this paper was to ascertain the number of peer-reviewed articles being published in orthopaedic journals across all sub-specialties within orthopaedic surgery

that related to HIV. We also sought to determine the geographic origin of the research and what proportion was being conducted in LIC, the setting that would most benefit from the research.

## MATERIALS AND METHODS

We searched the 'Clarivate Analytics' Web of Science database to obtain all indexed articles regarding HIV published in all orthopaedic journals listed on the database. We then filtered this to search just the last 10 years, going back from the time point the search was conducted (January 2007 to September 2017). Inclusion criteria consisted of articles limited to English language publications. We used Web of Science as it is possible to filter journals so only English language orthopaedic journals are included.

Search terms used on the database consisted of the following: 'human immunodeficiency virus' OR 'HIV'. We then recorded the number of articles returned for each journal. Subsequently, abstracts and full texts were reviewed for each article to determine its relevance. This was done by two of the researchers (Brennan C and Graham SM).

Articles were included if the main focus of research was HIV. Excluded articles were those that had no relevance to HIV or had an additional focus such as tuberculosis, as well as letters or comments.

All relevant indexed articles were analysed for the following information: journal title, year of publication, geographic location and country, level of evidence and number of citations. The level of evidence was determined in accordance with the criteria established in the *Journal of Bone and Joint Surgery American Volume*<sup>[10,11]</sup> following review of abstracts and full texts.

Countries producing research were categorised into high-income countries (HIC), upper and lower middle-income countries (UMIC/LMIC) and low-income countries (LIC) according to the World Bank data for the current 2020 fiscal year<sup>[12]</sup> (Table 1).

## RESULTS

There are 76 orthopaedic journals listed on the Web of Science database. Initial searches showed that there were 168 published articles relating to HIV across 37 different orthopaedic journals (48.7% of the listed journals).

Of these 168 articles, 68 (40.5%) were published in the time frame analysed for this paper (January 2007 to September 2017), in 26 different orthopaedic journals (34.2%). (See Table 2 for full list of journals).

The 5 orthopaedic journals with the most papers relating to HIV in that time period each had 5 published articles. These were: *The Journal of Bone and Joint Surgery-American volume*; *Journal of Arthroplasty*; *Injury*; *Skeletal Radiology* and *The Journal of the American Podiatric Medical Association*.

The 68 articles originated from 20 different countries (See Table 3 for full list of countries).

The majority of publications originated from the United States ( $n = 34$ , 50%), with the next four highest yield countries being: United Kingdom ( $n = 7$ , 10.3%), South Africa ( $n = 6$ , 8.8%), Malawi ( $n = 5$ , 7.4%) and Ireland ( $n = 4$ , 5.9%) respectively. Of the 68 articles, 9 (13.2%) were collaborations between authors or groups from different countries.

Of the 20 countries producing research into HIV in orthopaedic surgery, research from 5 countries was solely collaborative and there was no individual research output from that country. These countries were Malawi (5 collaborative articles), Norway (2 collaborative articles), Australia, Canada and Japan (each with 1 collaborative article).

The majority (13/20, 65%) of research output, including the collaborative research, was from HIC. They accounted for 78% (46/59) of the non-collaborative articles, as well as 100% of the collaborative articles. Only 4 countries (20%) were UMIC, with a research output of 12 of the 68 articles (17.7%) and 2 collaborative articles. There were just 2 (10%) LMIC, which produced 3 articles (4.4%), none of which were collaborative research papers. Finally, only 1 country (5%) was a LIC. This was Malawi, and 100% of the research from there was collaborative and with authors from HIC.

Collaborative research was conducted between: HIC and HIC, HIC and UMIC or HIC and LIC (See Table 4 for a full list of the countries participating in collaborative studies).

Sixty-six of the 68 included articles (97.1%) were low level of evidence articles (IV or

**Table 1 Countries divided by their economic status, as per World Bank classifications (10)**

High-income countries	Upper middle-income countries	Lower middle-income countries	Low-income countries
Australia	Brazil	Cameroon	Malawi
Canada	China	Nigeria	
France	South Africa		
Germany	Turkey		
Ireland			
Italy			
Japan			
Netherlands			
Norway			
South Korea			
Spain			
United Kingdom			
United States			

V) and there were no level I or II high evidence studies. The remaining 2 articles were level III evidence and none were from LIC. One was a systematic review and meta-analysis of observational studies looking into gait and balance impairments as a result of HIV infection<sup>[13]</sup> and was a collaborative paper from South Africa and Germany. The other being a systematic review of studies looking at correlation between osteopaenia and HIV from Brazil<sup>[14]</sup>. The vast majority of low level of evidence articles (IV or V) was case reports or case series.

## DISCUSSION

This study has shown that there is little research conducted into HIV and its impact on orthopaedic surgery. Fewer than half of all the orthopaedic journals have any published research on the subject and less than half of this has been produced in the preceding 10-year period analyses in this research paper.

People living with HIV in all income settings are living longer<sup>[15,16]</sup> and therefore there is a call for more research to be conducted to facilitate the practice of evidence based medicine in treating these patients. Studies have shown equivocal evidence as to whether HIV is an independent risk factor for outcomes in orthopaedic surgery such as post-operative infection or fracture union, again highlighting the need for further research to be carried out to further evidence based practice<sup>[17-20]</sup>. A good example of this is seen in the systematic review by Wijesekera *et al*<sup>[6]</sup>, which showed no statistically significant difference between infection rates following surgery in HIV-positive patients compared to control groups in 3 different studies, but one smaller cohort study did report a significantly higher infection rate in the HIV-positive group compared to controls. This highlights a need for more higher level of evidence research to be conducted.

Despite the fact that the vast majority of people living with HIV are located in low- and middle-income countries, with an estimated 68% living in sub-Saharan Africa<sup>[21]</sup>, the majority of publications focusing on HIV in orthopaedic literature originate from high-income countries. South Africa has the world's largest HIV positive population<sup>[22]</sup>, yet we have found that less than 10% of research looking in to this subject originated from South Africa. The overriding majority of research came from the United States which has 7 times fewer people living with HIV compared to South Africa<sup>[21]</sup>. There were only 2 LMIC countries, Cameroon and Nigeria, that had any published research on HIV amongst the orthopaedic journals listed and both of these were low level of evidence. Only 1 LIC, Malawi, had any articles in the orthopaedic journals on the database and these were all collaborative studies with HIC but once again were all low level of evidence. This shows a struggle for LIC and LMIC to publish research, particularly high level of evidence studies, in a subject that has a

**Table 2 Orthopaedic journals with published articles on human immunodeficiency virus in the last 10 years**

Journal name	Number of articles
<i>Journal of Bone and Joint Surgery-American Volume</i>	5
<i>Journal of Arthroplasty</i>	5
<i>Injury</i>	5
<i>Skeletal Radiology</i>	5
<i>Journal of the American Podiatric Medical Association</i>	5
<i>Clinical Orthopaedics and Related Research</i>	4
<i>Physical Therapy</i>	4
<i>Spine</i>	4
<i>BMC Musculoskeletal Disorders</i>	4
<i>Acta Orthopaedica</i>	3
<i>Spine Journal</i>	3
<i>Archives of Osteoporosis</i>	3
<i>Orthopedics</i>	3
<i>International Orthopedics</i>	2
<i>Bone and Joint Journal</i>	2
<i>Journal of the American Academy of Orthopaedic Surgeons</i>	1
<i>Journal of Shoulder and Elbow Surgery</i>	1
<i>Journal of Orthopaedic Research</i>	1
<i>European Spine Journal</i>	1
<i>Osteoarthritis and Cartilage</i>	1
<i>Foot and Ankle International</i>	1
<i>Journal of Pediatric Orthopaedics</i>	1
<i>Orthopaedics &amp; Traumatology – Surgery and Research</i>	1
<i>Indian Journal of Orthopaedics</i>	1
<i>Acta Orthopaedica Belgica</i>	1
<i>Acta Ortopedica Brasileira</i>	1
Total = 26	68

greater impact on their patient demographic than those in HIC.

Possible reasons for this are the barriers faced by LIC in implementing research studies such as issues with funding, lack of expertise in conducting high level research or reluctance of journals to publish research from LIC. The lower publication rate from LIC could also be due to authors in this setting not being well informed about how to get published even in the context of higher quality research.

The Lancet report<sup>[23]</sup>, “Global Surgery 2030: Evidence and solutions for achieving health, welfare and economic development”, highlights the need for financial support in helping LIC and LMIC achieve the surgical care to meet population demand. This also includes improving research capabilities in these countries to improve overall surgical care. We found in this study that research in HIV and orthopaedics coming from LIC was through collaborative efforts with HIC. The Lancet report also highlights the need to develop effective research collaborations to maximise the impact of research outcomes.

As well as funding, the capacity for LIC to be able to carry out high level research is hindered by the fact their physicians are required to serve a much greater population with fewer resources. World bank data<sup>[24]</sup> on the number of physicians per population show that a LIC such as Malawi has only 0.016 doctors per 1000 people (as of 2016), whereas a HIC like the United Kingdom has 2.806 doctors per 1000 people (as of 2017). This, combined with the fact the burden of trauma is greater in LIC<sup>[25]</sup>, make high

**Table 3 Countries of origin for articles on human immunodeficiency virus in the last 10 years**

Publication country of origin	Number of articles (collaborations)
United States of America	34 (2)
United Kingdom	7 (3)
South Africa	6 (2)
Malawi	5 (5)
Ireland	4 (1)
Brazil	3 (0)
Cameroon	2 (0)
China	2 (0)
Germany	2 (0)
Norway	2 (2)
Australia	1 (1)
Canada	1 (1)
France	1 (0)
Italy	1 (0)
Japan	1 (1)
Netherlands	1 (0)
Nigeria	1 (0)
South Korea	1 (0)
Spain	1 (0)
Turkey	1 (0)

**Table 4 Collaborative research by country of origin and economic status**

HIC: HIC	HIC: UMIC	HIC: LIC
United States: Ireland	United Kingdom: South Africa	United Kingdom (+Australia): Malawi
United States: Japan	Germany: South Africa	United Kingdom: Malawi
United Kingdom: Australia (+Malawi)		Norway: Malawi
		Norway: Malawi
		Canada: Malawi

HIC: High-income countries; UMIC: Upper middle-income countries; LIC: Low-income countries.

orthopaedic research output in these settings difficult. This again highlights the need for greater collaborative effort in producing high evidence research between HIC with more resources and LIC, where exists the larger population of HIV positive patients.

Lastly, readers of journals are more likely to be from HIC settings due to access and availability of resources. This can result in a reluctance of journals wanting to publish research from LIC as it can often be less relevant to their target audience.

### Limitations

A limitation of the study is the fact that our Web of Science database search methodology selected solely orthopaedic journals and therefore any articles in journals not listed on their database as an orthopaedic journal would not have been included in the search results. This includes any orthopaedic publication in non-orthopaedic journals, such as the *Lancet*, or in virology focused journals, such as the *Journal of Medical Virology*. Furthermore, in clinical practice and in literature in low-income countries, trauma and orthopaedics is often grouped with other surgical specialties

and publications such as the *Tropical Doctor* and *East and Central African Journal of Surgery*, which are not included on the Web of Science database. This may have led to an underestimate of the number of orthopaedic research articles published on the topic of HIV.

## CONCLUSION

People living with HIV are living longer and are becoming more prone to various musculoskeletal and orthopaedic complaints, as a result of both their treatment and age-related conditions. We have found that there is little research conducted looking at how HIV affects outcomes in orthopaedic surgery and that the research that is being done is preferentially carried out in HIC rather than LIC, where these problems are more prevalent. Current research tends to be of a low level of evidence. Collaborative research between LIC and HIC has proven to be a useful method for increasing research output in the LIC setting. This article highlights a greater need for high level of evidence research in this field to be carried out and done so in the LIC setting where it is of most benefit. One way this can be achieved is through more collaborative efforts with HIC.

## ARTICLE HIGHLIGHTS

### **Research background**

Human immunodeficiency virus (HIV) has become a chronic health problem with advances in treatment, and the chance of orthopaedic surgeons encountering it in clinical practice is increasing. It is also known that HIV may present with various musculoskeletal manifestations or treatment may result in a number of orthopaedic pathologies. There is little research in the current literature investigating how HIV affects outcomes in orthopaedic surgery.

### **Research motivation**

The current literature highlighted a lack of research looking at the effects of HIV in trauma and orthopaedic surgery, particularly coming from geographic areas most in need of this evidence base for clinical practice. By highlighting this gap in the literature, it should pave the way for future research to be conducted in the appropriate setting to help improve outcomes in this patient cohort.

### **Research objectives**

This study aimed to investigate the quantity and quality of peer-reviewed publications in orthopaedic journals about HIV.

### **Research methods**

A bibliometric analysis was conducted using the 'Clarivate Analytics' Web of Science database. All articles in orthopaedic journals relating to HIV were identified. All relevant articles were analysed for the following information: journal title, year of publication, geographic location and country, level of evidence and number of citations. This is a novel research method for determining the volume and quality of publications about HIV in trauma and orthopaedic surgery.

### **Research results**

Less than half of orthopaedic journals listed on the Web of Science database had articles published relating to HIV. Only 168 articles were identified in the literature, with only 40.5% ( $n = 68$ ) published in the time frame analysed in the study (January 2007 to September 2017). These articles tended to be low level of evidence papers. The majority of research output came from high-income countries and any articles published from low-income countries were collaborations.

### **Research conclusions**

The findings of this study show that there is a need for more research to be carried out on how HIV affects outcomes in orthopaedic and trauma surgery. This further research should be carried out in the area of greatest clinical need, particularly in low-income countries, where the burden of disease is higher. One way to achieve, as

shown from the results of this study, is with greater collaborative research efforts between high-income and low-income countries.

### Research perspectives

The direction of future research should be focused on larger scale clinical trials, including collaborative studies, investigating the effects of HIV in orthopaedic and trauma surgery to produce high level of evidence research, to improve clinical outcomes.

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