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Is there plagiarism in the most influential publications in the field of andrology?

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Abstract

Plagiarism is a common form of academic misconduct that extensively jeopardises the quality of scientific publication. The purpose of this study is to determine the extent of plagiarism in the most influential andrology articles. A total of 77 highly cited andrology articles were analysed for their similarity index using iThenticate and Turnitin. The articles were categorised based on the year (before and on/after 2000) and type of publication (review and research articles), and the similarity indices were compared. Furthermore, the analysed articles were categorised based on the level of similarity using an arbitrary similarity index range (low: ≤10, moderate: 11–20, high: 21–50 and very high: >50) and average incidence rate (%) was determined. Our analysis revealed a higher percentage of the similarity indices for reviews than research articles. We noticed a higher similarity index for articles published on/after 2000 than those published before. The majority of the influential articles in the field of andrology showed a low similarity index, while some articles exhibited moderate to high levels of similarity. These findings support the need for the development of similarity index guidelines as a major pre-requisite for establishing a more transparent and efficient system to address plagiarism in scientific publications.

KEYWORDS

andrology, plagiarism, plagiarism detection tool, scientific misconduct, similarity index

1 | INTRODUCTION

Publication of research findings in scientific journals serves as a significant focal point for dissemination of scientific knowledge (Baral, 2011; Rousseau, Egghe, & Guns, 2018). Scientific writing and publications in reputable, peer-reviewed, indexed journals proclaim the expertise of the researcher(s) and facilitate recognition of the author as an authority in the field by academic peers (Baral, 2011). The number of citations garnered by an article is often used as a tool to measure the significance and impact of the researcher's work in their field (Agarwal et al., 2016). Moreover, the ability to publish in high impact factor journals is widely considered as an indication of the quality and scientific merit of the studies conducted by researchers. Although published articles serve as a basis and guide for future research, in recent years, scientific articles published in journals appear to be increasingly plagued by scientific misconduct in the form of plagiarism (Pastor, 2018).

According to the Federal Research Misconduct Policy, plagiarism is defined as "the appropriation of another person's ideas, processes, results, or words without giving appropriate credit" (https://ori.hhs.gov/federal-research-misconduct-policy). Plagiarism can take place in different forms, ranging from either literal (word

for word) or substantial copying, or paraphrasing without acknowledging the source, to text recycling or self-plagiarism (Committee, 2017; Elsevier, 2019; Masic, 2012). The rise in plagiarism could be attributed to the escalating competition and pressure to publish along with the vast amount of scholarly content that is easily accessible online (Pastor, 2018). Whether plagiarism occurs intentionally or unintentionally (Joob & Wiwanitkit, 2018), the lack of research integrity constitutes a worrying trend within the scientific community that must be addressed.

Commercially available plagiarism detection software such as iThenticate and Turnitin is a handy resource to ensure the originality of content. Using these or similar software, researchers could self-evaluate their own article(s) for content originality prior to submission. Despite these available measures, plagiarism attributes to a substantial percentage of rejection of manuscripts and retraction of published articles (Debnath, 2016). In fact, plagiarism was reported as the second most common reason for post-publication retraction in biomedical journals published between 2000 and 2015 (Moylan & Kowalczuk, 2016). While the onus is on the researcher to submit a scientifically sound research article to a journal, the editors and the peer reviewers also share the responsibility to ensure the integrity of the articles published.

Debnath and Cariappa (2018) have emphasised the need for all scholarly journals to have a well-defined plagiarism policy on a journal's homepage as well as in the "Instructions to Authors" (Debnath & Cariappa, 2018). In the field of reproduction and andrology, journals such as Fertility and Sterility (https://www.fertstert.org/content/authorinfo#idp1660368), Reproductive Biology and Endocrinology (https://www.biomedcentral.com/getpublished/editorial-policies), Reproductive BioMedicine Online (https://www.rbmojournal.com/content/authorinfo) and Asian Journal of Andrology (http://www.ajandrology.com/aboutus.asp) have stated on their website that the submitted article may be checked for originality using Crossref Similarity Check. Meanwhile, journals of the European Society of Human Reproduction and Embryology (ESHRE) such as Human Reproduction (https://academic.oup.com/humrep/pages/Policies) have clearly stated in their website that manuscripts are screened using plagiarism detection software, iThenticate, either during the submission process or before its final acceptance. The Andrology journal declares on its website that submitted articles may undergo a screening process to identify duplicate content (https://onlinelibrary.wiley.com/page/journal/20472927/homepage/forauthors.html). Moreover, most of the journals in the field of reproductive medicine and andrology are members of the Committee on Publication Ethics (COPE), a nonprofit organisation that provides support to publishers and editors in upholding ethical practices in publishing (https://publicationethics.org/members). Nevertheless, some journals such as Andrologia have not stated anything about conducting a plagiarism check on submitted manuscripts on their website. However, the practice of routine checking of all submission has been adopted by Andrologia in recent years (personal communication with the Editor-in-Chief of *Andrologia*). In general, journals do not reveal what they construe as an appropriate cut-off level of similarity index for their respective journals based on the results of plagiarism detection screening.

Our search on PubMed (on 16 May 2019) using the term "plagiarism" retrieved a total of 1,706 articles, which were mainly journal articles (54% or 917/1,706) and Editorials (24% or 412/1,706). Moreover, the number of publications addressing the various aspects of plagiarism shows an increasing trend with 1,421 articles published in the past 20 years, 1,010 articles in the last decade and 477 within the last 5 years. However, these articles did not appear to broach aspects of what an acceptable level of text similarity might be for scientific publications. The increasing number of articles published on plagiarism, particularly in the recent years, implies that perhaps the scientific community has gained sufficient awareness and concern regarding this type of academic misconduct. Nevertheless, a cross-sectional online survey on the awareness of publication ethics among corresponding authors with various publishing experience (n = 4,043 from 100 countries) found a large variability in perceived knowledge, training and ethical standards (Schroter et al., 2018). These reports unequivocally exemplify the need for a more transparent system in addressing plagiarism. In this context, establishing an appropriate percentage similarity cut-off level serving as a reference point for both authors and editors is a major pre-requisite. As an initial step towards this, the present study aimed to determine the extent of similarity in a set of highly cited articles published in the field of andrology using two commercially available plagiarism detection software.

2 | MATERIALS AND METHODS

2.1 | Ethics statement

The present study did not involve any human subject participation, and the entire analysis was performed using commercially available plagiarism detection software, iThenticate and Turnitin. Hence, it was exempted from the Institutional Review Board (IRB) review and approval.

2.2 | Plagiarism software, study sample and design

Turnitin and iThenticate are commercial plagiarism detection software of iParadigms LLC. Turnitin was launched in 1997 and is primarily used for originality checking by educational institutions worldwide. Turnitin's database provides an incomparable repository of >70 billion web pages, 1 billion student papers and top scholarly content (69 million subscription articles) from >1,700 publishers around the world (https://www.turnitin.com/about/content). iThenticate was launched in 2004 and is widely used by scholarly publishers and research institutions to ensure the novelty of the write up before publication. iThenticate compares the manuscript against its huge database of over 60 billion web pages and 155 million contents, which includes 49 million works from 800 scholarly publishers (http://www.ithenticate.com/about). All the articles

included in this study were subjected to plagiarism check using both Turnitin and iThenticate, the most widely used software in scientific publications (Carter & Blanford, 2016; Meo & Talha, 2019).

2.3 | Plagiarism analysis

2.3.1 | Study sample and design

A bibliometric analysis conducted by Bullock, Ellul, Bennett, Steggall, and Brown (2018) had identified the 100 most influential manuscripts in andrology based on their citation score (Bullock et al., 2018). As these manuscripts serve as "highly citable" and standard reference articles in the field of andrology for both clinicians and researchers, we enlisted these articles for plagiarism analysis. From the 100 most cited publications, only articles for which we had access to full text and those that complied with the inclusion/exclusion settings of the software were analysed (n = 77) and reported.

A total of 77 articles were analysed for their similarity index using iThenticate and Turnitin (Table S1). The articles were categorised based on the year of publication (before and on/after 2000) and type of publication (review vs. research articles), and their similarity index was compared. Furthermore, the analysed articles were categorised based on the level of similarity using an arbitrary similarity index (%) range (low: ≤10, moderate: 11–20, high: 21–50 and very high: >50) and the average incidence rate (%) was determined.

Initially, a pilot study was conducted involving six most cited andrology articles (randomly chosen from the list of 100 articles), which were independently analysed for similarity index by different operators using iThenticate (n = 3) or Turnitin (n = 3). Inter-observer agreement was confirmed by comparing the similarity indices generated by individual operators (n = 3) for iThenticate or Turnitin software.

2.3.2 | Plagiarism check

The articles were analysed using iThenticate and Turnitin software as per the following steps:

Step 1: A new folder was created in the software domain with the following settings:

- Exclude bibliography, exclude small matches with an exclusion threshold of 10 words, and limiting the search repositories to Crossref, Crossref posted content and publications.

Step 2: The articles were uploaded to the folder and subjected to plagiarism check.

Step 3: The initial similarity report generated by the software was reviewed, and the following results were excluded using filters:

- Original source article being analysed.
- Publications/cross-references published either on the same year or later than that of the analysed article.

Step 4: The final report was generated as a portable document format file.

2.4 | Statistical analysis

All the data analyses were performed using MedCalc Statistical Software (version 17.8; MedCalc Software). Initially, the data were tested for normal distribution using the Kolmogorov–Smirnov test. Similarity index (%) is represented as mean ± SD. Spearman's rank correlation coefficient was calculated for the articles analysed using Turnitin and iThenticate software. Furthermore, the Wilcoxon test and the Mann–Whitney test were carried out to compare the paired and independent samples (articles), respectively, and a $p < .05$ was considered significant.

3 | RESULTS

3.1 | Inter-observer and inter-software agreement for Turnitin and iThenticate

Statistical analysis of pilot study data revealed no significant difference (p = .0625) between the similarity indices of articles (n = 6) generated by iThenticate or Turnitin software. The inter-observer agreement (average measure) between the operators (n = 3) for iThenticate and Turnitin software was 0.9508 and 0.9612 respectively.

3.2 | Comparative analysis of similarity index generated by Turnitin and iThenticate

Based on the pilot study results, the most influential and highly cited articles (n = 77) in the field of andrology were analysed using both software and the level of plagiarism was expressed as percentage

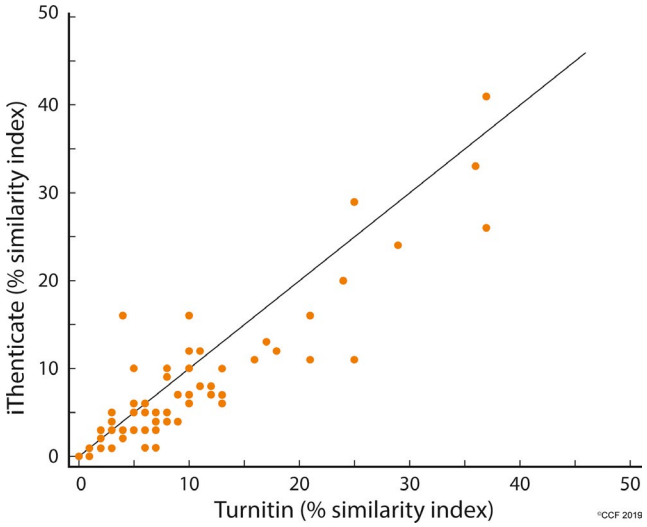


FIGURE 1 Scatter plot illustrating the correlation between the percentage similarity index generated using Turnitin and iThenticate software

TABLE 1 Similarity index (%) of the most influential articles in andrology categorised by the type of article

Type of most influential publication	Turnitin (Mean ± *SD*)	iThenticate (Mean ± *SD*)	Wilcoxon test (*p*)	Rank correlation* (*ρ*)
All article types (*n* = 77)	8.6623 ± 8.6185	6.9870 ± 7.8329	<.0001	.885
Original research articles (*n* = 59)	7.1356 ± 6.7171	5.3729 ± 4.9127	.0001	.879
Review articles (*n* = 18)	13.6667 ± 11.9804	12.2778 ± 12.3803	.2153	.929

*$p < .0001$.

of similarity index. The mean similarity index (%) of the most influential articles ($n = 77$) was significantly ($p < .0001$) higher in Turnitin (8.66% ± 8.62) when compared to iThenticate (6.99% ± 7.83). However, a significant positive correlation ($\rho = .885$, $p < .0001$) was observed between the results obtained from these two software (Figure 1 and Table 1).

Furthermore, the similarity indices of research and review articles were analysed separately using both software. Similarity index (%) for the most influential research articles ($n = 59$) was 7.14% ± 6.72 and 5.37% ± 4.91 using Turnitin and iThenticate respectively. The similarity index (%) obtained from Turnitin and iThenticate for research articles showed a significant positive correlation ($\rho = .879$, $p < .0001$). On the other hand, the most influential review articles ($n = 18$) showed a similarity index (%) of 13.67% ± 11.98 and 12.28% ± 12.38 using Turnitin and iThenticate respectively. Similar to research articles, similarity index generated by the two software for review articles showed a significant positive correlation ($\rho = .9299$, $p < .0001$; Table 1).

3.3 | Level of similarity in the most influential articles based on the year of publication

We assessed the level of similarity based on the year of publication by comparing articles published before ($n = 40$) and on/after ($n = 37$) the year 2000. Analysis revealed similar results with respect to similarity detected by iThenticate and Turnitin in articles published before and on/after 2000 (Table 2). Both software showed a statistically significant difference ($p < .0001$) with articles published on/after 2000 having a higher level of similarity compared to articles published before 2000 (Table 2). Furthermore, the average of similarity indices between iThenticate and Turnitin also showed significantly ($p < .0001$) higher level of plagiarism in the articles published on/after 2000 (11.8 ± 9.4), when compared to the articles published before 2000 (4.2 ± 3.9; Figure 2).

TABLE 2 Similarity index of the most influential andrology articles published before and on/after the year 2000

Publication period	Similarity index (%)	
	Turnitin (Mean ± *SD*)	iThenticate (Mean ± *SD*)
Before 2000 (*n* = 40)	4.6500 ± 4.5322	3.6750 ± 3.8457
On or after 2000 (*n* = 37)	13.0000 ± 9.8658	10.5676 ± 9.3884
p-value	<.0001	<.0001

3.4 | Incidence rate of similarity in the most influential andrology articles

An arbitrary similarity index range was applied to rank the articles into different percentage similarity categories, as there are currently no clear guidelines on categories of similarity index and relevant cut-off values that could serve as an indication for the level of plagiarism. Our analysis demonstrated that 79.22% ($n = 61$) and 74.03% ($n = 57$) of the articles were ranked as low similarity (≤10%) by iThenticate and Turnitin, respectively. However, this was not statistically significant ($p = .7127$). Similarly, there was no significant difference ($p > .05$) in the incidence rate of plagiarism determined using iThenticate and Turnitin while categorising the articles into moderate and high similarity (11%–20%, 21%–50%; Figure 3). Furthermore, none of the articles showed very high similarity (>50%) in either Turnitin or iThenticate. The average incidence rate of low, moderate, high and very high levels of plagiarism was determined to be 76.72%, 14.29%, 9.09% and 0%, respectively (Figure 3).

4 | DISCUSSION

Plagiarism is an imperative issue in the field of scientific writing that profoundly compromises the quality of publication. It ranges

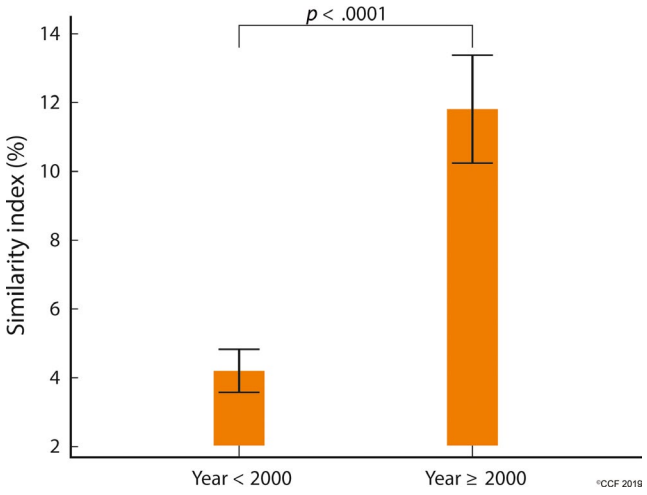
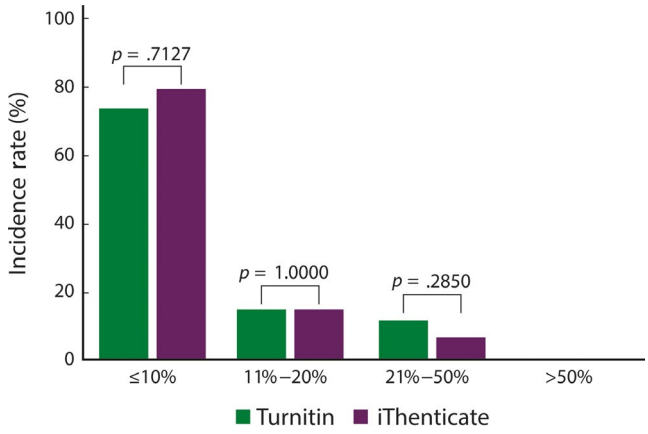


FIGURE 2 Average similarity index of the most cited andrology articles published before and on/after the year 2000



Similarity index (%) range	Incidence rate (%)		Average incidence rate (%)
	Turnitin	iThenticate	
≤10%	74.03	79.22	76.62
11%–20%	14.29	14.29	14.29
21%–50%	11.69	6.49	9.09
>50%	0	0	0

FIGURE 3 Incidence rate of plagiarism in the most influential andrology articles based on similarity index range

from simple discrepancies to significant duplication of manuscripts without appropriate citation of the original source(s) (Das & Panjabi, 2011; Kumar, Priya, Musalaiah, & Nagasree, 2014). Plagiarism remains as a significant and increasing problem in academia, with a reported 10-fold increase in article retractions over the last 20 years (Kumar et al., 2014; Smart & Gaston, 2019). The adoption of plagiarism software by journals has revealed a significant level of plagiarism in the submitted articles, which was not previously detected (Butler, 2010). Despite the increased number of publications regarding plagiarism and ethics of publications, there is no transparency on the permissible cut-off level of plagiarism adopted by scientific journals, particularly in the field of andrology. Analysing the published andrology articles for plagiarism might provide a better glimpse of allowable plagiarism level, if there is any. Therefore, the present study was conducted to analyse the high impact andrology articles and determine the level of plagiarism in those influential articles using plagiarism detection software.

Our analysis revealed higher mean similarity index for the most influential andrology articles by Turnitin when compared to iThenticate. The degree of variability in similarity index (%) generated by the two software could be due to the difference in their database or algorithm used to detect the plagiarism. Both of the commercial software use different databases to meet the needs of their users. Turnitin is used mainly in educational institutions, while iThenticate is widely used by publishers and researchers. iThenticate compares the manuscript against over 60 billion web pages and 49 million articles from 800 scholarly publishers (http://www.ithenticate.com/about). On the other hand, manuscript subjected to plagiarism check using Turnitin undergoes scrutiny against its unparalleled database of >70 billion web pages, 1 billion student papers and 69 million articles from >1,700 publishers (https://www.turnitin.com/about/content). In the present study, higher similarity indices reported by Turnitin could be attributed to its wide range of database. Furthermore, our analysis revealed a higher similarity index for reviews than research articles. Based on this observation, we speculate that review articles are more prone to plagiarism than research articles. A possible explanation for our speculation is that research articles are based on original research and documented for the first time; hence, the possibility of having elements of plagiarism is minimal. On the contrary, review articles summarise previously published findings from the literature rather than reporting new results.

Our results also demonstrated a significantly higher level of similarity in articles published on/after the year 2000 when compared to those published before. This finding could be due to various reasons pertaining to progress in scientific research as well as the continuing advancement in technology. To begin with, growth in the field of andrology research over the past few decades can be easily acknowledged. A recent bibliometric study revealed a phenomenal increase in male infertility research over the past 20 years and noted that about 3,311 articles related to male infertility were published in 1998, while the number increased to 8,772 in 2017 (Baskaran et al., 2019). Zhang et al reported that only one original research article was included in the PubMed database in 1960, while the number increased to 574 articles by 1990, and 866 articles by 2012. Furthermore, 56 male infertility journals were identified in 1995 and it increased to more than 200 in 2012 (Zhang et al., 2016). These findings could be indirectly linked to higher level of plagiarism due to the exponential increase in the number of available resources. Furthermore, advancements in computer technology particularly, the introduction of Internet in 1991, could be another reason for the increased rates of plagiarism after the year 2000. All publications became accessible online, and medical search engines such as PubMed (1996) and Scopus (2004) ensured that the scientific information is not farther than a click away.

Apart from the vast and easily available resources, mounting academic competition and pressure perhaps play a significant role in the observed increase in plagiarism over the period (Fanelli, 2010). Beyond dissemination of knowledge, research publications contribute to numerous academic benefits and personal gain, including academic positions and promotions based on their reputation of quality scientific work and rigour. Consequently, there is a significant pressure on academics to publish for numerous reasons, including the "publish or perish" mantra for academic career paths, academic ambitions, vanity and ego of individuals and financial pressure (Masic, 2012). The academic misconduct or intellectual dishonesty arises from these academic pressures, including falsification of data, fabrication of data and plagiarism (Masic, 2012; Smart & Gaston, 2019). Academic pressure drives researchers to be more productive in a short period of time through utilisation of published resource as a means for faster productivity making them susceptible to plagiarism (Fanelli, 2010).

A recent study investigated the extent of self-plagiarism in various research areas using Turnitin software (Horbach & Halffman, 2019). It was reported that text recycling is relatively common and correlated with the authors' overall productivity and occurrence in articles with fewer authors. It can be argued that some level of reproducibility is unavoidable, particularly in subsections like materials and methods, which may significantly overlap within specialised disciplines (Meo & Talha, 2019). No threshold of similarity is universally accepted using these software packages, although above 25% would be considered high similarity (Meo & Talha, 2019). A threshold of 10% for text recycling has been suggested to be problematic for academic publication by Horbach and Halffman (2019), based on previous indicated threshold value (Bretag & Carapiet, 2007). Based on these reports, it was therefore reasonable to set a similarity index range of ≤10% to represent the articles with low similarity. Although many journals appear to use a similarity rate of 10% as a relevant cut-off for any form of plagiarism, it is believed that some of them use the threshold value up to 25% or even 35%, and review articles may have higher editorial thresholds (Mahian et al., 2017; Meo & Talha, 2019). Therefore, the use of more conservative scores to classify moderate similarity and an expansive range for high similarity provides a ranking system that represents an ideal hierarchy for analysis. Implementing this ranking system sheds light on the potential impact of plagiarism within these influential articles.

Our results suggest that the majority (76.62%) of influential articles in andrology have a low similarity and therefore could be considered less susceptible to the influence of plagiarism. It could also be inferred that a threshold of similarity index ≤10% has been adopted by most of the journals included in our analysis. With 14.29% of articles recorded as moderate similarity, this may still be considered within the appropriate considerations of the journal thresholds of <25% (Mahian et al., 2017; Meo & Talha, 2019). It is safe to say that 90% of these influential articles are within the allowable plagiarism level based on this index, while 9.09% articles on average scored a high similarity (21%–50%), and none of the articles scored a very high rate (>50%) of similarity.

Overall, our results indicate that the level of plagiarism based on similarity index in the majority (~77%) of the most influential andrology articles is low. This suggests that there is a low-to-moderate degree of plagiarism within these significant and influential articles in the field of andrology. However, it is important to caution that these findings cannot be extrapolated to the broader field of andrology as this cohort of published articles did not involve less cited articles or articles from journals with a low impact factor. Hence, additional retrospective analysis on a wider scale is required to further examine the potential incidence of plagiarism in the field of andrology.

Plagiarism has a pernicious effect on the quality of scientific publications, which in turn threatens the reliability of a published article. This is the first study to demonstrate the level of plagiarism in andrology-related articles. The majority of influential articles in andrology showed a low similarity index, while some articles exhibited moderate to high level of similarity, but none of the article showed a very high level of similarity. With the advent and increasing use of plagiarism detection software by journals/publishers, our results clearly demonstrate the need for a development of similarity index guidelines to standardise acceptable levels of textual similarity for scientific publications.

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CONFLICT OF INTEREST

None of the authors have any conflicts of interest to declare.

AUTHOR CONTRIBUTIONS

AA and RH designed the study. All authors performed the data analysis. SB, MKPS, DD, KL, KK, AM and DS drafted the manuscript. All authors reviewed, edited and approved the final manuscript.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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