The African Academy of Sciences

Science in Media

Africa Science Desk Baseline Assessment Report

Hannah W. Waithera
African Academy of Sciences | 8 Miotoni Lane

Table of Contents

Acknowledgements iii

List of abbreviations v

Operational definitions v

CHAPTER 1: INTRODUCTION 1

Background Information 1

Literature Review 2

Scientists and Journalists 3

Scientists' views of the public: *What does the public know?* 5

Coverage of science stories... 6

Problem Statement 6

Assessment Questions 7

Assessment Objectives 7

Main Objective 7

Specific Objectives 7

Significance of the study 8

CHAPTER 2: METHODOLOGY 8

Setting 8

Study Design 8

Sampling Plan 8

Sample size calculation 8

Inclusion criteria 9

The lay public 9

Scientists 9

Journalists/Editors 9

Media Monitoring 10

Online Survey 10

Field Surveys 12

Online surveys 17

Lay public 17

Journalists 20

Scientists 24

Media Monitoring 27

Science stories published 27

Major publications with science stories 30
DISCUSSION AND CONCLUSION 32
Funding source 34
REFERENCES 35
Appendix 1: Content Analysis Coding Sheet 38

Acknowledgements

I would like to express my sincere appreciation to Deborah-Fay Ndhlovu, Elizabeth Marincola, and Paul Munyao for their guidance and constant supervision as well as for providing necessary information regarding the project & also for their support in completing the project.

My thanks and appreciation also go to Steven Wambua, Charles Njagi, data collection assistants, all the survey respondents and all the AAS staff for their support and for making this work a success.

Special thanks go to the Bill and Melinda Gates Foundation for funding this work under the Africa Science Desk project.

List of figures

Figure 1. Field survey participation by country, occupation, gender and residence type 12
Figure 2. Frequency of lay public of using different media sources 13
Figure 3. Importance level of different news beat as reported by different respondents 14
Figure 4. Attitude of lay public towards science stories by country 15
Figure 5. Do you read science stories and at what frequency?.....16
Figure 6. Science topic that needs more science coverage by country 17
Figure 7. Lay public online survey participation by gender.....17
Figure 8. Lay public online survey participation by level of education.....17
Figure 9. Frequency of online survey participants who read science stories.....18
Figure 10. Frequency of use of different media sources to read science stories.....18
Figure 11. Frequency of reading science stories among the lay public by level of education 18
Figure 12. Attitude of lay public towards science stories in media 19
Figure 13. Demographic representation of journalists in the online survey.....20
Figure 14. Journalists participation by the news beat covered and their perception on the coverage levels of different newsbeat.....21
Figure 15. Remuneration levels of journalists covering different newsbeat vs journalists' motivation for becoming science journalists.....21
Figure 16. Presence of a science desk and a science editor 22
Figure 17. Demographic representation of scientists in the online survey 24
Figure 19a. Scientists' frequency of using various media outlets.....25
Figure 19b. Scientists' perception on level of importance of different news beat 25
Figure 20. Scientists with articles published in media and media platforms used. 25
Figure 21. Scientists perceptions on quality of science stories published by media and the relationship between scientists and journalists 26
Figure 22. Scientists perception of science focus areas that need more media coverage 26
Figure 23. Distribution of science stories by country 27
Figure 24: Science stories published overtime 27
Figure 25: Trend of science stories published overtime in each country 28
Figure 26: AAS themes covered by science stories 29
Figure 27: AAS themes covered by country.....29
Figure 28: Major sections where articles featured 30
Figure 29: Sources of science stories in Kenya.....30
Figure 30: Sources of science stories in Nigeria.....31
Figure 31: Sources of science stories in Senegal.....31

Figure 32: Sources of science stories in South Africa 31

List of abbreviations

AESA - Alliance for Accelerating Excellence in Science in Africa

CARI - Coalition for African Research and Innovation

STEM – Science, Technology, Engineering and Mathematics

SA – South Africa

US – United States

Operational definitions

Media – the main means of mass communication (broadcast, publishing and internet)

Science stories – A narrative, audio or video film about any scientific topic covered by media.

Science coverage in the media – The extent to which science stories have been published and/or broadcast in the media compared to other news beats such as politics, sports, entertainment and business.

Lay public – a uniform group of non-experts with a little allowance for “any relevant expertise outside of the scientific community, or for any intermediate degrees of scientific knowledge or understanding” [1]

Scientists/Science experts – Based on previous studies, we use the term “scientist” as encompassing a broad array of individuals from across science, technology, engineering and mathematics-related fields, working in research and non-research positions, holding varied levels of post-graduate degrees, and employed across the university, government, non-governmental or industry sectors.

Science journalist – A person affiliated to a media institution to write or reports about science to the public on employment terms or as a freelancer.

CHAPTER 1: INTRODUCTION

Background Information

The Global Science Journalism Report (2013) describes science journalism as a dying profession due to newsroom closures of science desks across the globe [[2]. Observed trends in some jurisdictions support this assertion. The number of dedicated science sections in newspapers fell from about 95 to 34 between 1989 and 2005, according to the US National Association of Science Writers [3]. This has resulted in insufficient knowledge to promote scientific literacy among the public and to help scientists gain expertise in areas outside their own fields. Today's reality is very different: scientists, their institutions, and the scientific knowledge they produce are now entangled in new media environments encompassing YouTube (a video sharing platform created in 2005 and owned by Google), Facebook (a social networking platform founded in 2004), and a plethora of other new media platforms. Younger scientists support direct communication with unspecialized, "lay" audiences [4] and may discuss scientific findings outside of their specific spheres in the online realm, without any intermediary [5]. And most importantly, lay audiences themselves can participate in the production of science communication content, by producing and posting videos or blog posts, or more simply by commenting on an online item.

Africa is no exception to this state of science journalism, but it appears Africa's challenges are different. In Rooyen's study of the state of science and technology coverage in the print media of South Africa, for example, it concluded that there was a small percentage of science and technology articles published during the research period and the study points to a lack of science and technology coverage in the South African press as the reason [6]. In Africa, and all over the world, science stories are overtaken by politics, sports and business news. Some of the few science stories that are published and/or broadcast sometimes portray a lack of understanding of the issues being addressed due to the 'formal training deficit' on science journalism on the Continent. Stories are also often written based on press releases without adding value, providing analysis or further reporting. This has fueled "churnalism", where news organisations republish verbatim press releases issued by public relations agencies and campaign groups, raising concerns of the quality of science reporting. It also puts scientists and the public at considerable risk for commercial interests to exploit the opportunity for earned media by issuing as "news" what is actually a promotion for a product, service or company.

Despite this, there is recognition of the importance of the role science plays in promoting development. China in particular has developed at astounding rate because of its investments in science. Africa's investment in science remains at an average of 0.40% [7], which has

resulted in a limited capacity to produce and retain scientists on the Continent and improve the research infrastructure to help in generating the knowledge and data to impact the health and developmental challenges in the Continent.

Africa would need to invest US$2 billion of its own resources in order to augment international funding. This level of funding would enable the training of 40,000 PhDs over a decade, which would increase researcher head count and ensure sustained science-led development. The 2013 World Bank report documented the average number of PhDs at 1268 per million people. An increase in 'in Africa' investments for science will require advocacy and raising awareness of the impact of science. Initiatives like the Alliance for Accelerating Excellence in Science in Africa (AESA) and the Coalition for African Research and Innovation (CARI) are leading this advocacy. They, along with other initatives, will need to demonstrate the impact of science to philanthropic, private and public sector organisations to support science, technology and innovation. A major purpose of the science in the media project is to raise public awareness of science and its impact on society, including on the wellbeing of people, animals, crops and the environment, as well as being a driver of economic strength and independence in Africa.

Target countries for the science in the media project are Kenya, Nigeria, Senegal and South Africa. These countries have strong economies, making them good candidates for organisations looking to mobilise funding for science. Not coincidentally, these countries are some of the major producers of Africa's scientific output, a success story that remains underappreciated because of lack of media coverage. The main project seeks to change this *status quo* and raise the awareness required to promote uptake and increased funding for science.

Literature Review

Reports of new research findings are important to fuel novel findings and discoveries that are shared through the publication of science journals. However, the great majority of these scientific articles are aimed at an audience of other experts in highly specific fields, making them ill-suited for popular consumption. Between complex methodological language and frequent acronyms, even scientists have trouble following the jargon specific to other fields, leaving little hope for those with less scientific training. Although some science journals are multidisciplinary, most are highly specialized, and they publish articles related to specific scientific fields. Rigorous findings shared by researchers in specialist journals are obscured behind jargon and paywalls, while accessible science shared on the internet can be untrustworthy, unregulated and often click-bait. This calls for synergistic and active cooperation between scientists and journalists to bring science to a broader audience.

Mass media is an important source of science information for many adults. The media has the ability to affect public opinion and policy direction. The way news organizations translate scientific facts and frame stories builds meaning and significance within the public sphere [8].

Public perception of science topics is strongly influenced by media construction of scientific knowledge. Good reporting enhances the ability to evaluate related policy issues, and poor coverage misleads and disempowers citizens [9]. The selection of stories by journalists can help shape public policy as well as influence public support for and prioritization of such measures [9] [10]. These processes may also be referred to as the *agenda-setting* or *priming* powers of the media.

As Liu [11] observed, the media usually have one of two opportunities to influence public and policy agenda setting: influencing *salience* and influencing *views*. Salience is defined by Chyi and McCombs [12] as ‘‘the relative importance of an object – a public issue, a public figure, or any other topic – in the media or among the public.’’ Several studies have examined the role of the news media in influencing salience, the results of which indicate that media do affect the salience of issues amongst the public [12-16]. Media agenda setting studies have shown that the news media can influence the way that the public and policymakers view the issues, either negatively or positively [17-19].

Research has shown that when a specific topic receives a substantive amount of news coverage, the priority of that subject increases in public opinion [9, 20-23]. Similarly, Schudson found that “public amplification … provides a certification of importance”[24]. In fact, most people pay little attention to an issue or event until it “reaches saturation coverage and continues to make the news regularly for an extended period of time”[25]. Similarly, McComas and Shanahan contend that “it is not only the frequency of coverage, but also the character and form of that coverage that help to draw public attention.”[26] Further, establishment of clear connections among science, policy and the broader public interest can and do improve public understanding [23].

Scientists and Journalists

In Weingart’s words, science has become a fundamental “public issue” and the “object of constant media observation” [27]. Science is a particularly important component of certain issues in news making and reporting. However, the methods, timeframes and purposes of scientific research differ widely from those of news media. The news cycle is 24 hours at most, while the cycle of scientific research can be years. Scientists validate results by review and replication, which automatically outdates the story for the journalist. News reporting seeks ‘facts’ as definite and as unqualified as possible. The findings of science are often, in news terms, ‘qualified to death’. Joumalists are also focused on the production of stories whose

character fits well with news values. Scientists do not regard themselves as telling stories in this sense, although the character of their accounts in scientific papers is of course also directed by professional values. These cultural differences are a source of frequent conflict between journalists and scientists.

No reporter who covers science can long escape the horror stories of scientists about the (last) time their research was misreported in the media. Nelkin's survey of science journalism writes of the 'ubiquitous tendency to blame the press' among scientists, engineers, and physicians. Yet there is common ground between the two groups, and this lies less obviously at the heart of some of the conflicts which can occur. Both groups are interested in 'objective' and quantifiable facts, but may have different definitions of what constitutes a 'fact' and how it is verified. Both value accuracy highly. And both are in the business of competitive output, although through different outlets and with different timeframes. Scientists as authors are used to a high degree of control over publication. When the media are reporting, scientists lose that control, especially because journalists, following their own standard of professional ethics, are extremely reluctant to agree to requested checking back of copy.

Scientists are critical of media coverage generally, yet they also tend to rate favorably their own experience dealing with journalists, believing that such interactions are important both for promoting science literacy and for their own career advancement. Scientists believe strongly that they should have a role in public debates and view policy-makers as the most important group with which to engage. Few scientists view their role as an enabler of direct public participation in decision-making through formats such as deliberative meetings, and they generally do not believe there are personal benefits in investing in these activities.

We believe it is increasingly important to understand how scientists form judgments about the public sphere. With strong levels of societal trust and respect, scientists remain among the leading authorities called upon in policy debates to give media interviews, testify before political bodies or address public forums. In addition, as decision-makers in their organizations, many scientists are responsible for setting strategy, allocating resources and establishing communication priorities. Many scientists also contribute to the framing of controversies over topics such as climate change and stem cell research through blogging, political activism and other forms of public commentary, shaping societal interpretations about why an issue might be a problem, who or what is to blame and what should be done [28, 29].

Some scholars have argued that scientists have an ethical obligation to communicate their scientific findings to the public in the name of democracy [30-32]. On the other hand, there are a variety of barriers that have been identified by scientists as reasons why they avoid communicating with the public, including a lack of time, lack of value in terms of career

advancement, professional stigmatization, low awareness of potential public communication opportunities, and a lack of communication skills [30-35].

Scientists are often concerned with the potential misinterpretation of their findings by the media or public [32, 33, 36] and, as a result, they might resist communicating research findings through media [37, 38]. For example, previous studies have found that scientists believe that journalists leave important facts and methodological details out of media stories [35, 39]. A study by Long reporting a content analysis of science stories in US newspapers, found that while 70 newspapers carried science stories, the majority of these stories contained little scientific explanation [4]. This is attributed to the fact that editors tend to relentlessly cut out anything that would be boring to the lay reader, and this includes key details of scientific significance.

Scientists' views of the public: *What does the public know?*

Almost universally, scientists believe that the public is inadequately informed about science topics, including food risks [40, 41], genetic modification [42], chemicals [43] and even aquaculture [44]. Furthermore, a large majority of scientists believe that [45] the public is uninterested in becoming more knowledgeable [43]. As Davies [36] notes, these findings reflect a traditional "deficit model" of science communication that sees scientific illiteracy at the root of opposition to new technologies, environmental action and adequate science - funding.

The consequence, and cause, of the public's limited scientific sophistication has also been the subject of speculation by scientists. Several studies find that scientists view the public as non-rational and unsystematic in their thinking, relying on anecdotes [44, 46] and overreacting to minor risks [1, 40, 41]. Others have found that scientists see the public as emotional [47], fear prone [36], overly focused on the sensational [32], self-interested [43], and stubborn in the face of new evidence [1, 42]. Because of these perceived limits, scientists argue that scientific information needs to be simple, carefully worded [1], visual and entertaining [36, 40].

The 2001 Wellcome Trust study found that 53% of scientists said the main barrier to "greater understanding of science" among the public was lack of education. Another 35% said the problem was the media, 26% said the problem was lack of understanding about scientific processes, and 22% suggested that the problem was lack of interest. Less than a third suggested that the problem was with scientists. Among those that reflected on their own faults, 20% argued for lack of communication skills by scientists and 11% pointed to scientists' limited interest in public communication [48].

In addition to concerns over the public's level of knowledge, some studies also suggest that scientists do not believe the public trusts them [42, 44] and can be outrightly hostile [47, 49].

The prevalence of this impression is supported by the 2001 Wellcome Trust survey that found that 44% of scientists thought the public viewed scientists as uncommunicative, 46% thought scientists were seen as secretive, and 58% said scientists were seen as detached [48].

Coverage of science stories...

The media are instrumental in shaping public understanding of scientific issues [50]. It is well recognised that the media plays an enormously influential role in public response to health issues. The mass media -- print, television, radio and internet – has unparalleled reach as a communication mechanism [51]. Mass media has substantial power to set agendas that is, what we should be concerned about and take action on, and to frame issues, that is, how we should think about them [17]. People rely on media as an important source of health information [52-54]. However, media often do not provide adequate coverage of science topics associated with health inequities, such as sexual health, which means the needs of medically underserved communities for health information often goes unmet [54, 55]. Two important variables related to media coverage of science topics include the amount of coverage given to a particular health issue and the content of the health information. When the amount of media coverage on a particular issue is disproportionately low compared to the burden of disease, individuals are unlikely to view that health problem as having personal or community relevance [56].

Scientists and journalists are together dealing with two oppositional forces. On the one hand, scientists often complain, and become shy about engaging with the public at all, when they perceive that important nuance, methods and detail are left out of the reporting of their science to the public. On the other, the public tends to fail to engage science information when they perceive that it is too detailed, complex or qualified. The inability to strike a balance between these realities is a major barrier to improving the quantity and quality of research information for the public.

Problem Statement

Africa's researchers produce significant scientific output, a fact generally lost on the public because of lack of media coverage. Lack of media coverage, in turn, can be largely attributed to the fact that most of the scientific articles produced in Africa are aimed at an audience of other experts in highly specific fields, making them ill-suited for the lay public. Between complex methodological language and frequent acronyms, even scientists have trouble following the jargon specific to other fields, leaving little hope for those with less scientific training. Also pressing is the fact that people outside of well-funded research institutions can't even access most journal articles. Many of these papers are hidden behind a publisher paywall, and non-subscribers are forced to pay some amount to access even a single article.

Science stories can be helpful in demonstrating impact, raising awareness and building arguments to advocate for public resources. But with cash-strapped media organisations not prioritising science stories, it is difficult to demonstrate the impact of science, perpetuating low levels of scientific literacy among the public and policymakers, and thwarting efforts to mobilise support for the sector. Improving the quality of science reporting will take substantially increased resources and training.

The growth of science communication websites that solicit and address questions and feedback directly and immediately from the lay public provides some hope. These include Quora [57] and communities on Reddit such as AskScience [10]. The popularity of these resources (AskScience has over eight million subscribers) shows that a good portion of the public wants scientific information communicated, on demand, in an accurate and approachable manner.

Assessment Questions

This baseline assessment seeks to assess and address these critical questions:

- What is the trend of science coverage by the media?
- What are the perceptions of the public, journalists, scientists and policy makers towards science journalism?
- How can universal accessibility to useful science knowledge be enhanced?
- How can critical science information be best packaged for optimal consumption by policy makers at all levels?

Assessment Objectives

Main Objective

To assess the current science media landscape in Kenya, South Africa, Senegal and Nigeria with a focus on coverage and quality of science stories, and perceptions of science journalism in these countries.

Specific Objectives

1. To analyze coverage of science stories in relation to other news subjects in Kenya, South Africa, Senegal and Nigeria between October 2015 and September 2017.
2. To evaluate perceptions of the public/journalists/scientists/policy makers towards science journalism in Kenya, South Africa, Senegal and Nigeria.
3. To identify facilitators of and barriers to science reporting by the media in Kenya, South Africa, Senegal and Nigeria.

Significance of the study

The study will provide a reference point in working to improve science journalism in Africa through the building of awareness, mobilisation of resources and the training and development of science journalists to effectively communicate science and facilitate the use of science in decision making.

CHAPTER 2: METHODOLOGY

Setting

The study target countries are Kenya, Nigeria, Senegal and South Africa, whose strong economies make them good candidates for organisations looking to mobilise funding for science. These countries are some of the major producers of Africa's scientific output, which remains underappreciated by the public largely because of lack of media coverage.

Study Design

This is a baseline cross-sectional assessment using both qualitative and quantitative methods. Data will be collected through a desktop review and an online survey. Media monitoring of science stories will be done retrospectively.

The data extracted from the Meltwaters Media Monitoring tool will be coded using a predesigned content analysis coding frame. The data will be analysed quantitatively.

Some of the questions on the online survey questionnaire will also be analysed quantitatively since the responses can be quantified.

Sampling Plan

Sample size calculation

Sample size for the lay public, scientists and journalists will be calculated using the following formula:

$$N = \frac{t^2 \times p(1-p)}{m^2}$$

Where:

N = required sample size

t = confidence level at 95% (standard value of 1.96)

p = estimated prevalence of the variable of interest (estimated prevalence of the lay public (18 years and above) that use the media = 50% (0.5)

m = margin of error/confidence interval at 5% (standard value of 0.05) for scientists and journalists and 1% (standard value of 0.01 for the lay public)

Sample size for journalists and scientists

$N = 1.96^2 X 0.5 (1 – 0.5) / 0.05^2$

N = 384.16

Sample size = 385

Sample size for the lay public

$N = 1.96^2 X 0.5 (1 – 0.5) / 0.01^2$

N = 9604

The calculated sample size was 384 for scientists and journalists and 9604 for the lay public. Due to time and budget constraints, we worked with a sample size of 6000 for the lay public that is 2000 for the field survey and 4000 for the online survey. These sample sizes are sufficiently robust to make the findings significant notwithstanding the lower N than expected.

Inclusion criteria

The lay public

i. Individuals aged 18 years old and above.
ii. Individuals who give informed consent.

Scientists

i. Science experts with a specialization in any field of science.
ii. Scientists based either at an institution of higher learning or a science research organization.
iii. Scientists who give informed consent.

Journalists/Editors

i. Journalists affiliated with a media house
ii. Freelancing journalists.
iii. Media editors.
iv. Journalists who give informed consent.

Media Monitoring

Aim: To assess the coverage of science stories in Kenya, Nigeria, South Africa and Senegal in the period October 2015 – September 2017.

Target: Science articles available in the online repository – a central place on internet where data is stored and maintained.

Science stories published and broadcast in available online media outlets in the four countries over the period October 2015 to September 2017 will be retrospectively monitored. These articles are limited to articles that focus on the seven primary areas of AESA: health and wellbeing, climate change, food security and nutritional wellbeing, water and sanitation, sustainable energy, science advocacy and policy agenda, and STEM.

Key words: Science, Media, Journalism, Climate, Climate change, Health, Nutrition, Food security, Water, Sanitation, Energy, Science advocacy, Science policy, Technology, Engineering, Mathematics, Twitter, Newspaper, News briefs, Media broadcast, Kenya, Nigeria, Senegal, South Africa, Research.

The stories were coded using a pre-designed coding frame. See appendix 1.

Qualitative and quantitative content analysis of the results was performed.

Questions to be answered by the desk review/media monitoring/content analysis:

1. What are the gaps in science coverage by media in the four countries?
2. What is the coverage of science stories in the four countries over the two years of the study period?
3. What field of science is most reported?
4. What is the comparison of science reporting to other news beats such as politics, sports, entertainment, business?

Online Survey

Target: Journalists, members of the public, scientists

Aim:

- To determine the extent to which the public and scientists read science stories/articles published in the media.
- To determine perceptions of the public and scientists towards science journalism
- To explore measures that can be adopted to improve science journalism in Africa.

We designed a Survey Monkey vehicle that was distributed to the public, journalists/reporters/editors, and scientists via the Survey Monkey link to our mailing lists, the Meltwaters Media Monitoring tool influencer contacts and using various social media channels; Facebook, Twitter, and WhatsApp.

We engaged a social media campaign organization to manage the online survey for the lay public in the four countries. We awarded an incentive to encourage participation.

Questions to be answered by online survey:

1. What are the perceptions of the public of science stories?
2. What is the perception/attitude of scientists towards (science) journalists?
3. What is the extent of readership of science publications among the public and among scientists?
4. Does the media house have a science desk (dedicated coverage of science)?
5. Is a health and/or science editor present in the media house? If yes, how many?
6. What is the motivation to become a science reporter?
7. Which science topics need to be reported more, and why?
8. Is there a difference in remuneration between science journalists and journalists who cover other news beats?
9. Do science journalists have an educational background in science?
10. What sort of science journalism training should be offered to improve science reporting in the media?
11. Are journalists specifically focused on science or do they also cover other beats? What other news beat do they cover?
12. What are the opportunities for career development for science journalists compared to journalists covering other news beats (politics, entertainment, business)?
13. What role does science journalism play in shaping the state of science research in the nation/on the Continent?
14. What is the relationship between scientists and journalists?

CHAPTER 3: RESULTS

Field Surveys

Demographics

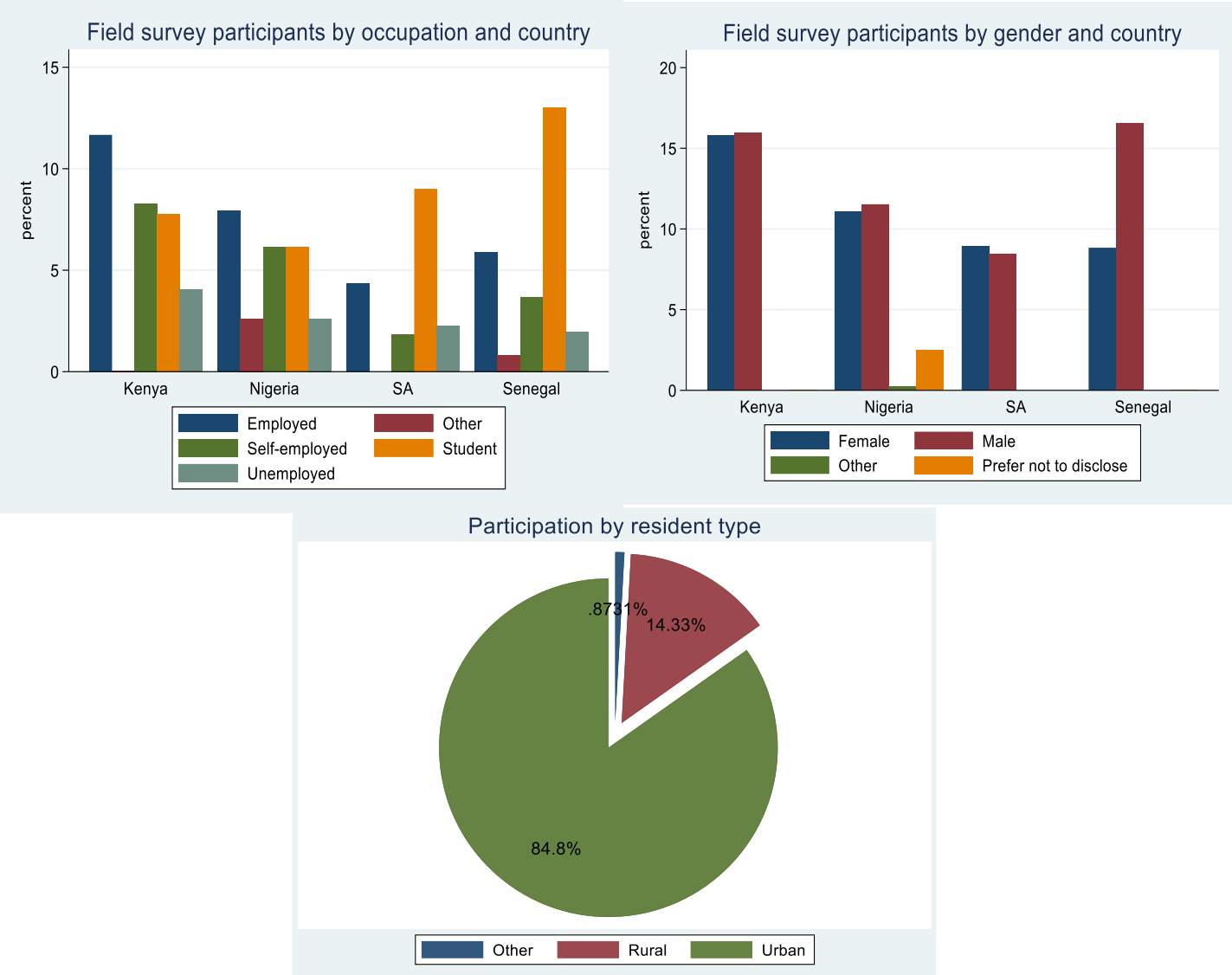


Figure 1. Field survey participation by country, occupation, gender and residence type

Figure 1 above indicates that Kenya had the highest number of participants, followed by Nigeria and Senegal, while SA had the least. The majority of participants were students for all the countries except Kenya, where the highest number of its participants were employed. Gender distribution across all the countries was predominantly male.

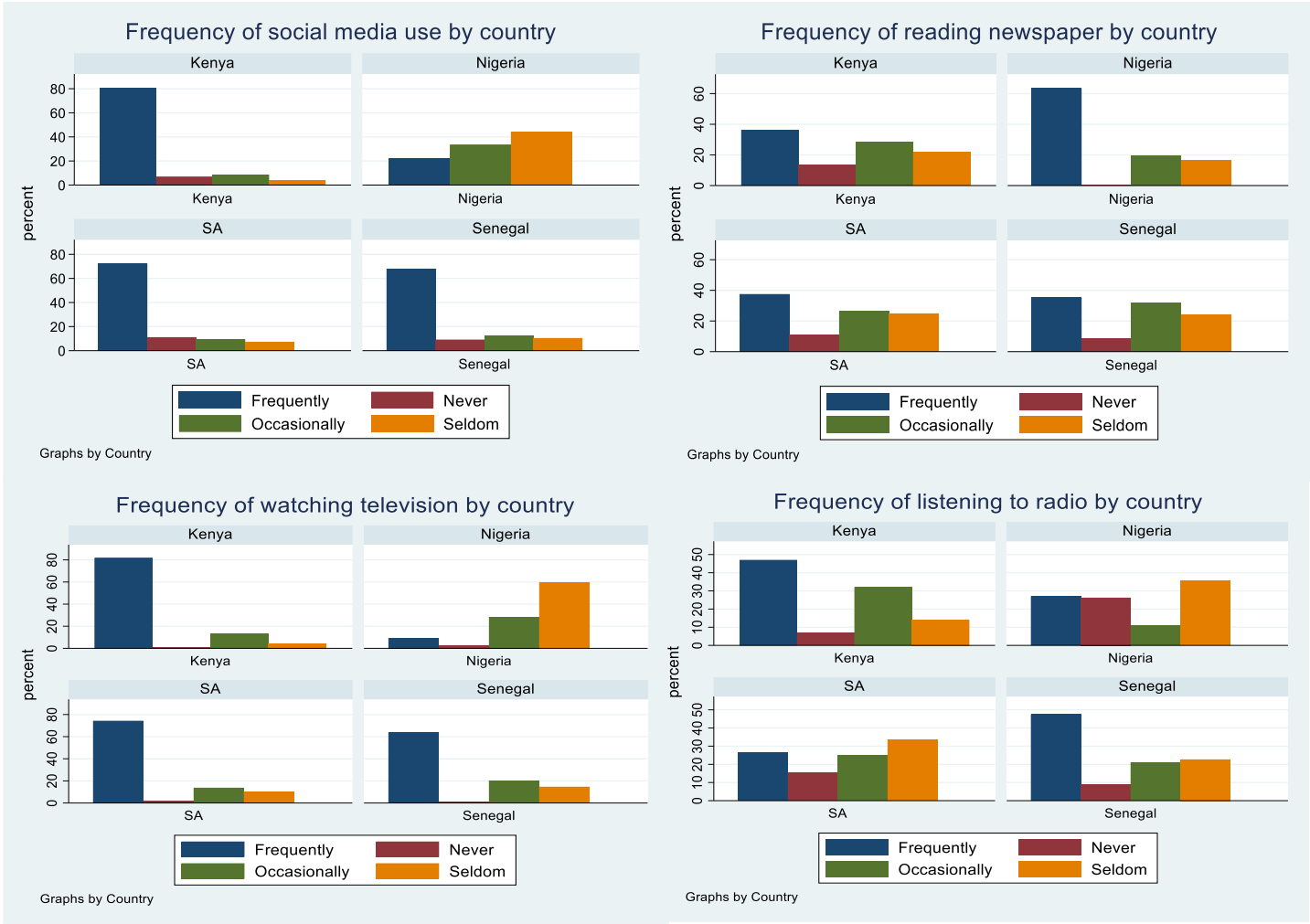


Figure 2. Frequency of lay public of using different media sources

The bar graphs in figure 2 above show the frequency of different media sources; print, broadcast and online.

The majority of respondents in Kenya, SA and Senegal reported using television, social media and radio to access science stories, while the majority of participants in Nigeria reported more dependence on the newspapers.

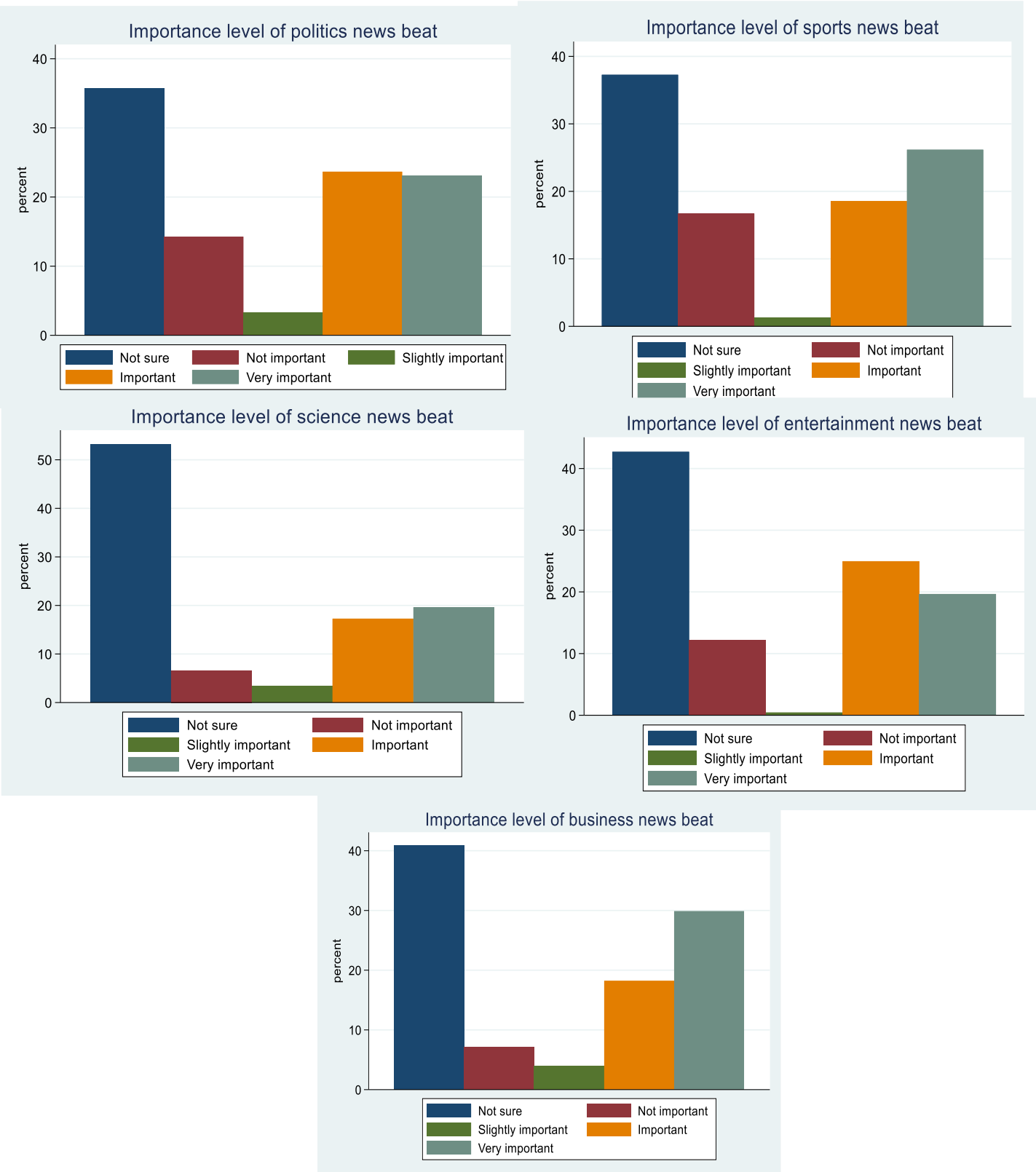


Figure 3. Importance level of different news beat as reported by different respondents

The bar graphs in figure 3 above show the importance of different news beats as reported by the respondents. Most of participants were not sure of the level of importance they attached to each of the different newsbeat covered. However, of the participants who had an idea of

their level of importance for different newsbeats, more felt that sports stories were very important, followed by business and then politics. Science was rated fourth on the '*very important*' and '*important*' scale.

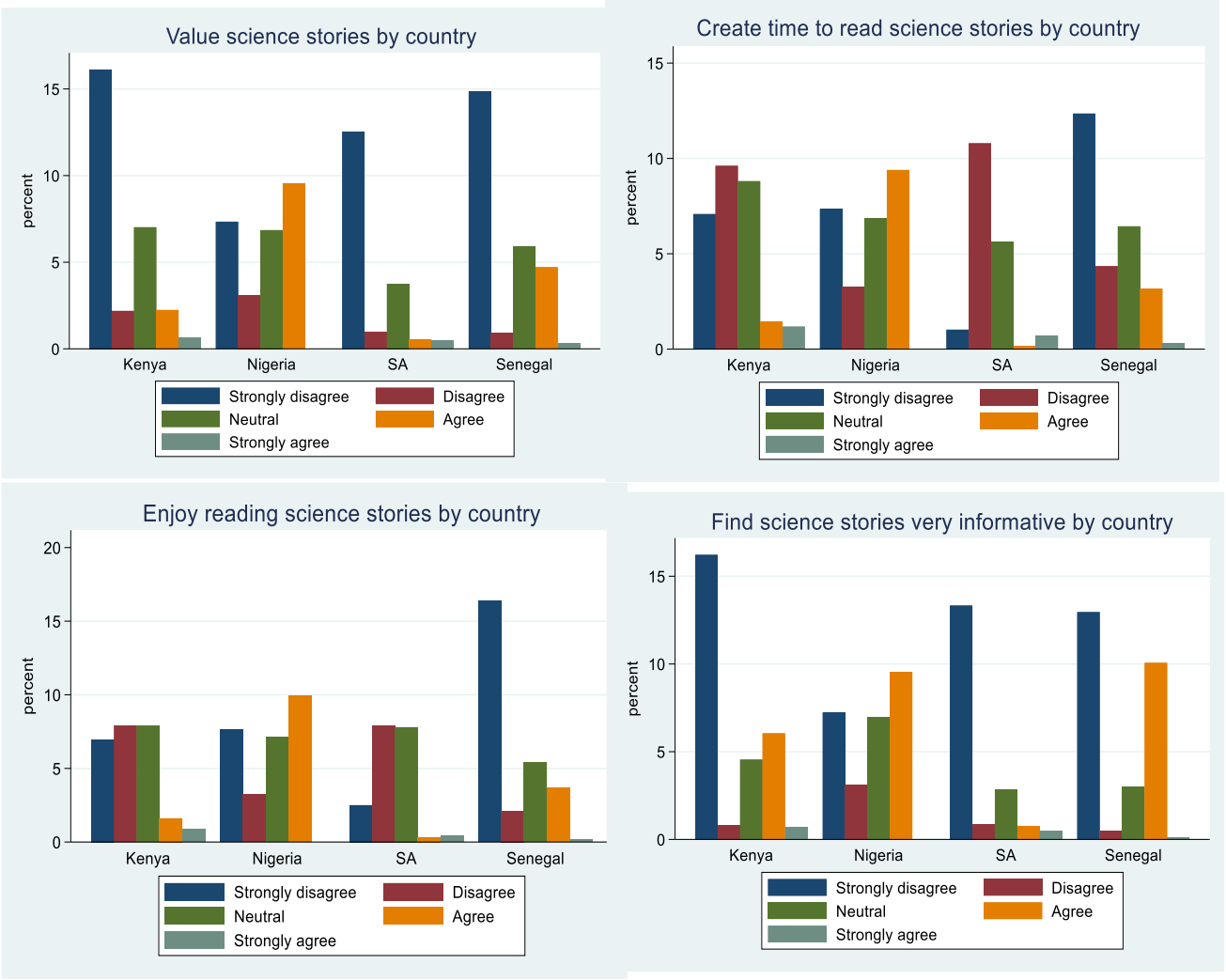


Figure 4. Attitude of lay public towards science stories by country

We used a set of four questions to assess the attitude of the lay public towards science stories. The questions are:

i. Do you value science stories?
ii. Do you create time to read science stories?
iii. Do you enjoy reading science stories?
iv. Do you find science stories very informative?

Figure 4 above shows that the majority of the participants in Kenya, South Africa and Senegal strongly disagreed that they either value science stories or that they find science stories in media very informative. On the other hand, most of the participants from Nigeria answered all four questions affirmatively with 'strongly agree'. Most of participants in Kenya and South Africa were neutral about enjoying reading science stories, while most of the participants in Senegal strongly disagreed that they enjoy reading science stories.

We went a step further to find out whether participants spared some time to read science stories and at what frequency. Most of the participants in Kenya, Nigeria and South Africa reported that they don't read science stories, while most in Senegal answered 'don't know' whether they read science stories. Of the participants who reported reading science stories, the greatest number in Kenya and South Africa reported reading science stories frequently while most in Nigeria and Senegal reported reading science stories only occasionally.

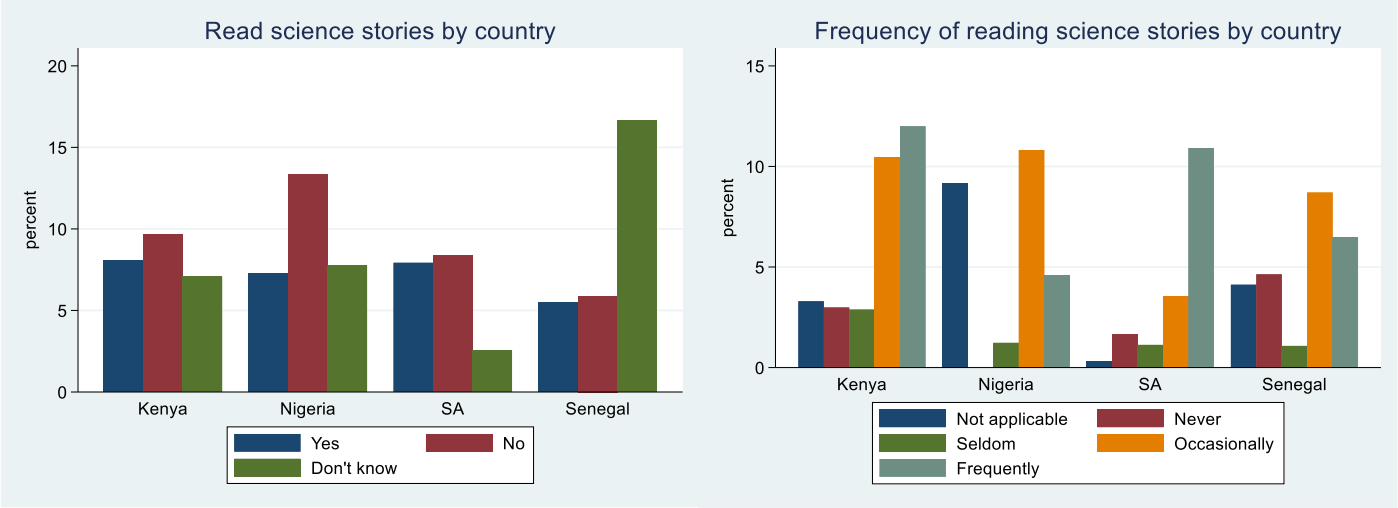


Figure 5. Do you read science stories and at what frequency?

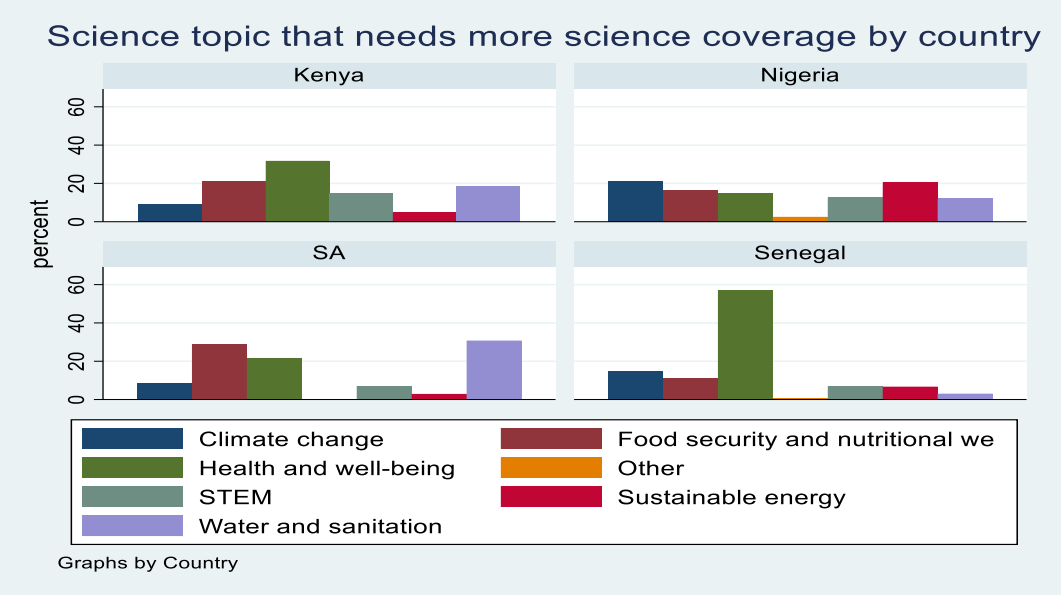


Figure 6. Science topic that needs more science coverage by country

Respondents from Kenya and Senegal felt that health and well-being requires more science coverage. On the other hand, participants from South Africa felt that water, sanitation and food security needed more science coverage, while participants in Nigeria felt that all the topics covered needed more science coverage.

Online surveys

Lay public

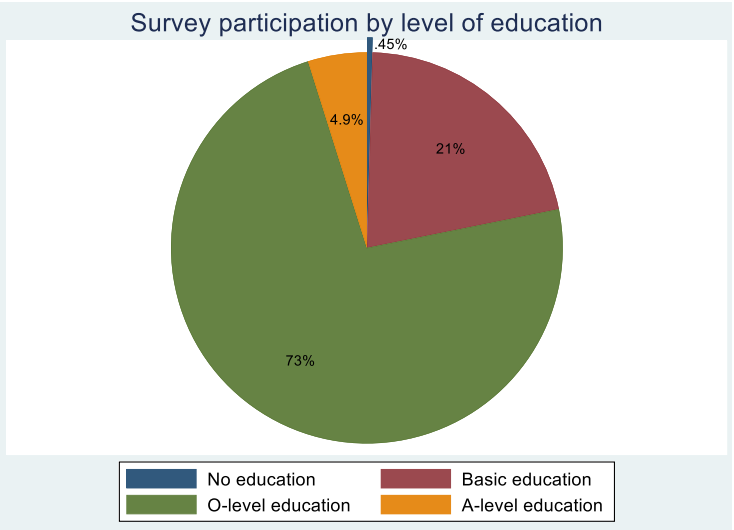


Figure 8. Lay public online survey participation by level of education

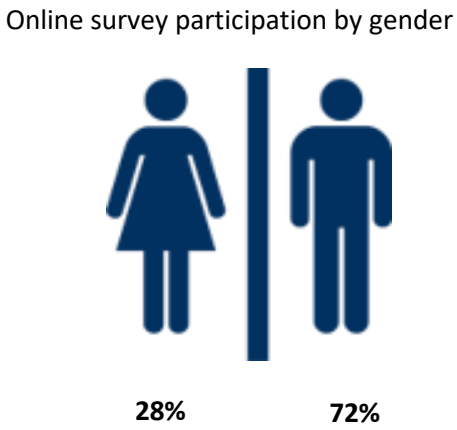


Figure 7. Lay public online survey participation by gender

The majority of the lay public who participated in the online survey had o-level education (73%) with the highest number being male (72%).

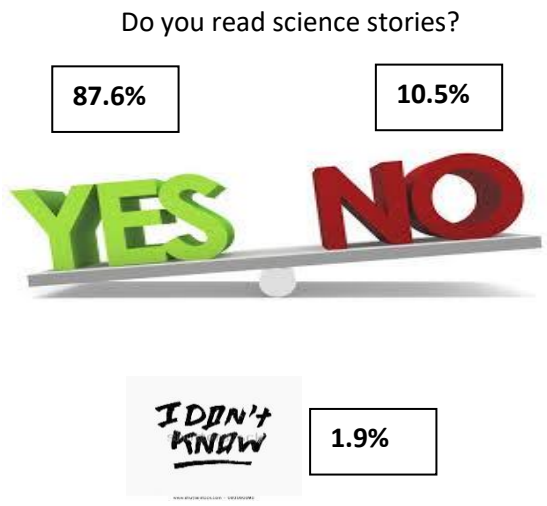


Figure 9. Frequency of online survey participants who read science stories

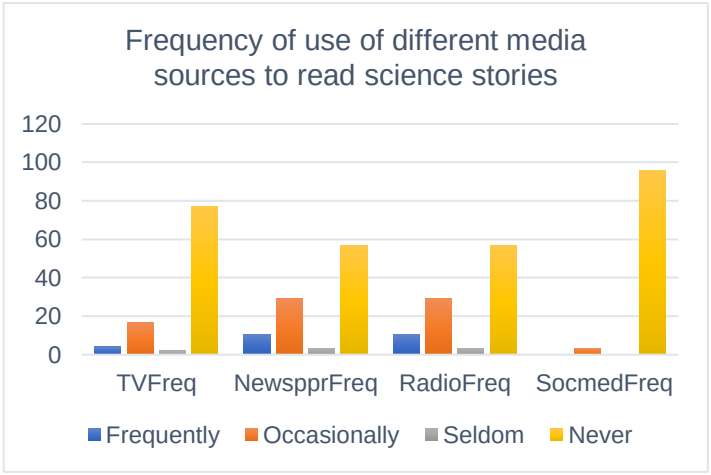


Figure 10. Frequency of use of different media sources to read science stories.

On assessing the proportion of the public who consumes science stories, 87.6% answered 'yes' while 10.5% said 'no' (see figure 9). This shows that the lay public is interested in science stories in media. About 30% of the public who answered 'yes' reported mainly depending on newspapers and radio (30% and 35% respectively) to consume sciences stories. (see figure 10).

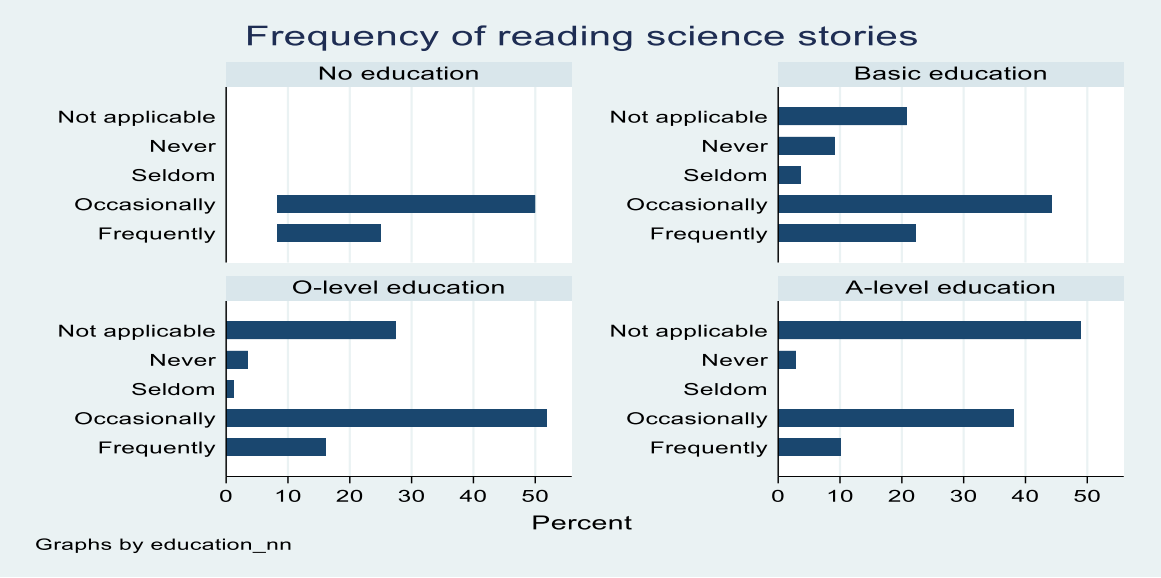


Figure 11. Frequency of reading science stories among the lay public by level of education

The frequency of reading science stories in the media was found to be highest among the lay public with basic education and o-level education (see figure 11).

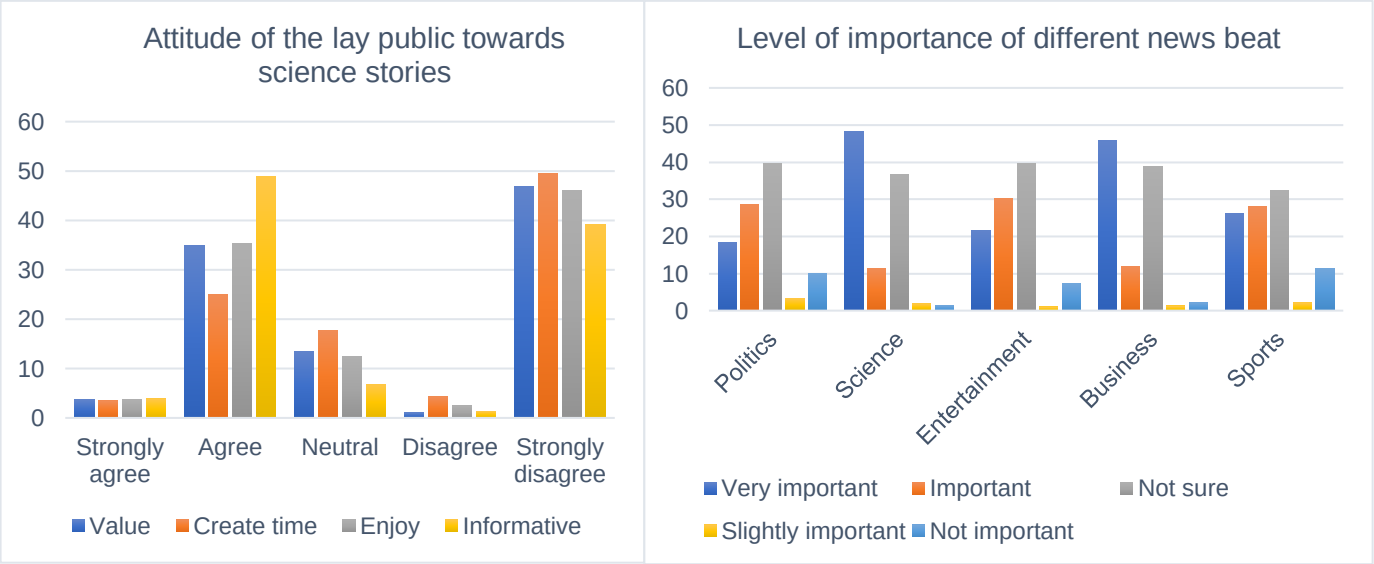


Figure 12. Attitude of lay public towards science stories in media

Just as with the field survey, we used a set of four questions to assess the attitude of the lay public towards science stories. The questions were:

i. Do you value science stories?
ii. Do you create time to read science stories?
iii. Do you enjoy reading science stories?
iv. Do you find science stories very informative?

From figure 9 below, 30-48% of the lay public participants agreed that they either value, create time, enjoy reading science stories and/or that they find science stories very informative. However, 30-49% of respondents indicated that they 'strongly disagree' with all four questions. We further assessed the level of importance the public attached to each news beat covered by media in relation to the science newsbeat. Science was rated number one by 48% of respondents who considered science 'very important', while business was rated number two with 46% considering it 'very important'. This indicates that the attitude of the public towards science stories in media is 'positive'.

Journalists

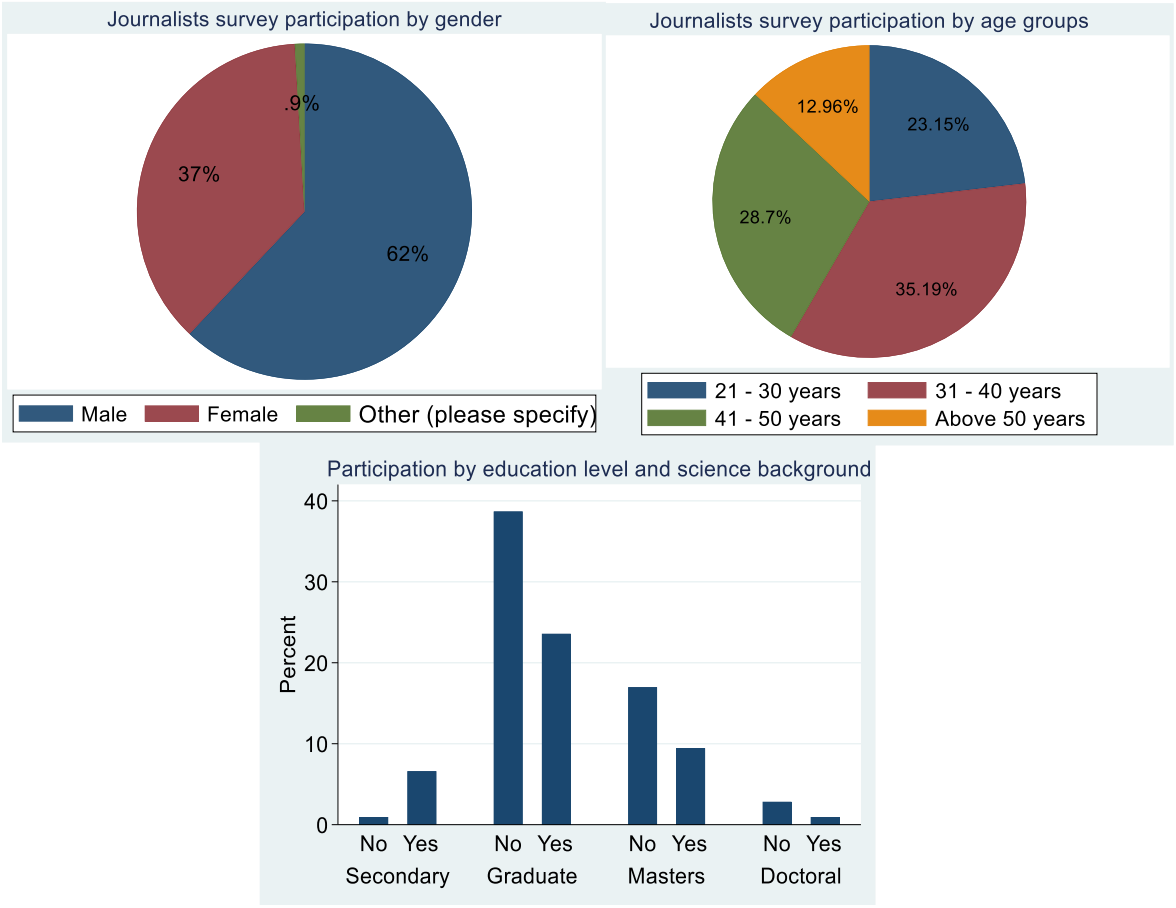


Figure 13. Demographic representation of journalists in the online survey

The online survey of journalists was represented by 62% male and 37% female. About 64% fell in the 31-50-year age-group. About 90% of the journalists who participated had o-level and masters education, but about 60% did not have a science background.

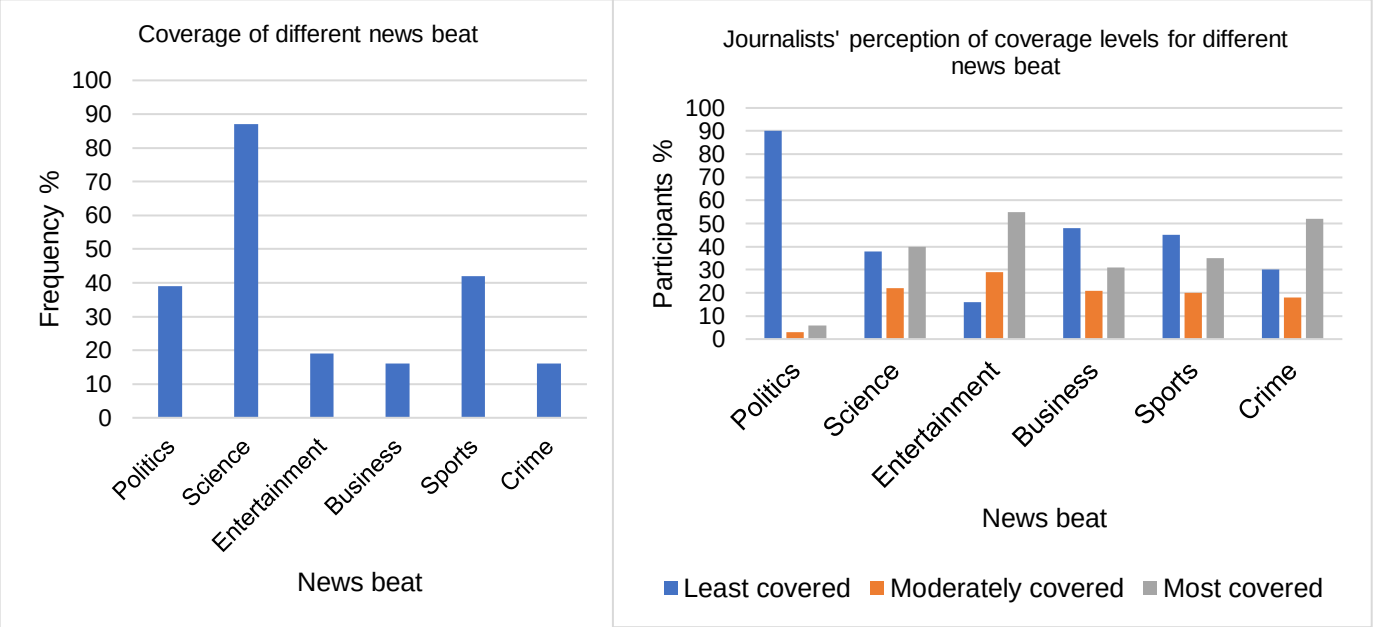


Figure 14. Journalists participation by the news beat covered and their perception on the coverage levels of different newsbeat

The majority of the journalists who participated in the online survey (87%) covered science stories. The majority of journalists felt that science stories were not well covered and assessed their frequency of coverage at an average of 40% of coverage of other newsbeats.

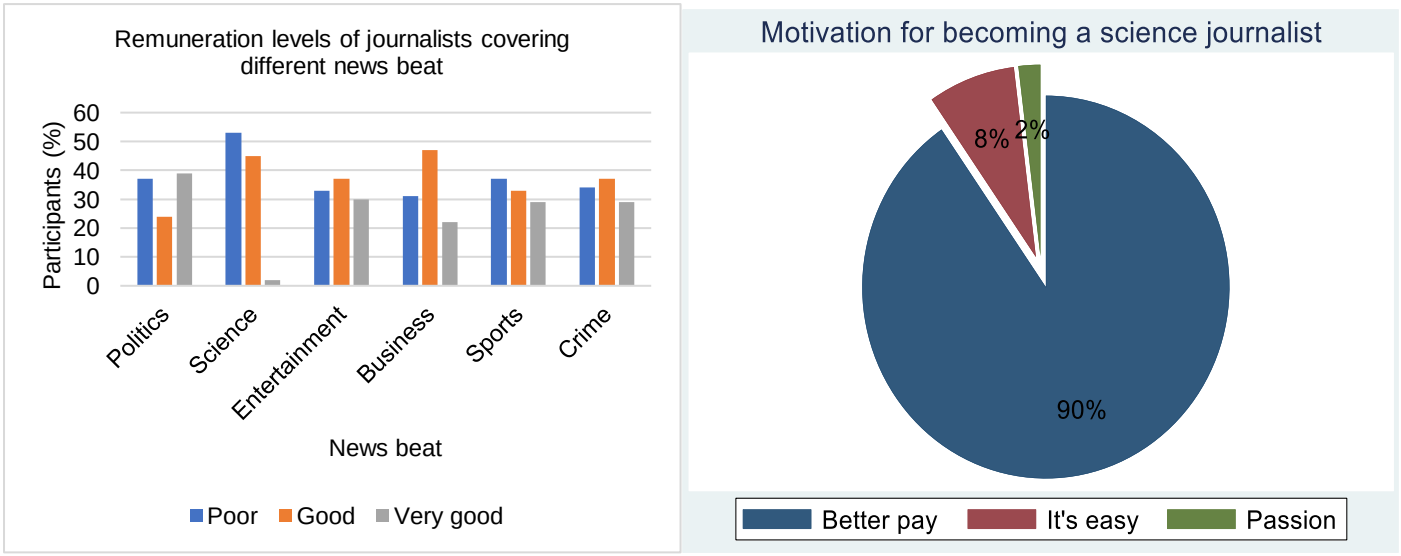


Figure 15. Remuneration levels of journalists covering different newsbeat vs journalists' motivation for becoming science journalists

journalists reported remuneration of science journalists to be considerably poorer to journalists covering other newsbeats. But this was contradicted by the self-perceptions of science journalists themselves: 90% reported 'better pay' as one of their greatest motivations to become science journalists. On further probe, science journalists reported more opportunities to freelance for multiple media organisations than journalists covering other newsbeats. This would be consistent with the lack of dedicated news desks for science – media outlets that never had or closed their science desks are more reliant on freelancers to cover science than they are reliant on freelancers to cover areas where desks are maintained (business, politics, entertainment, sports.)

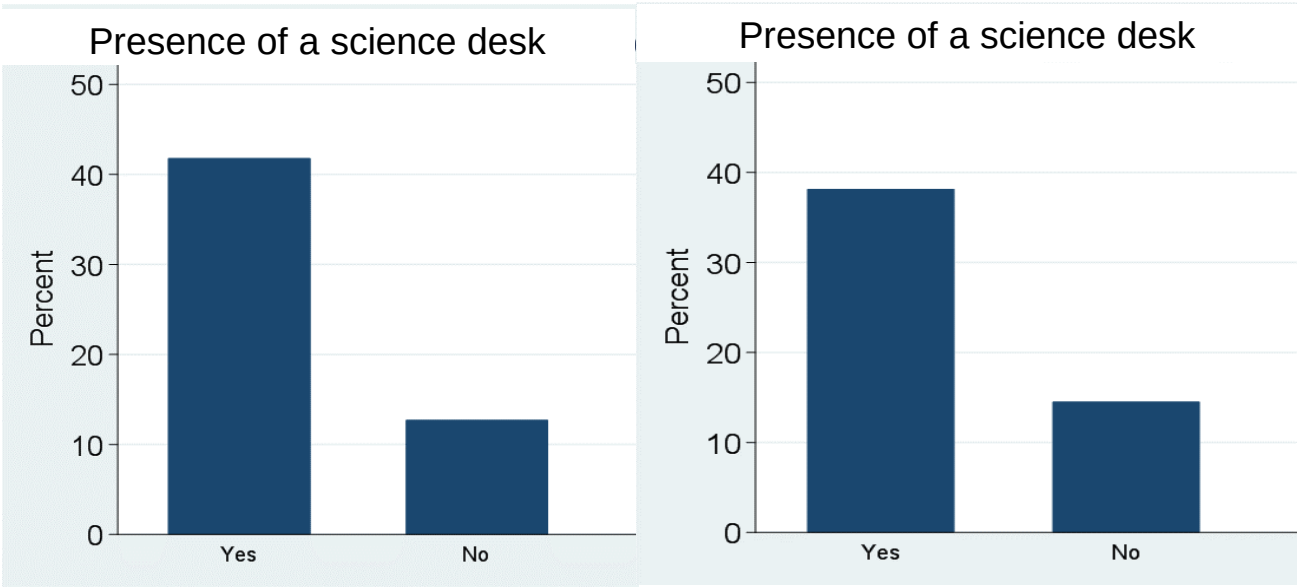
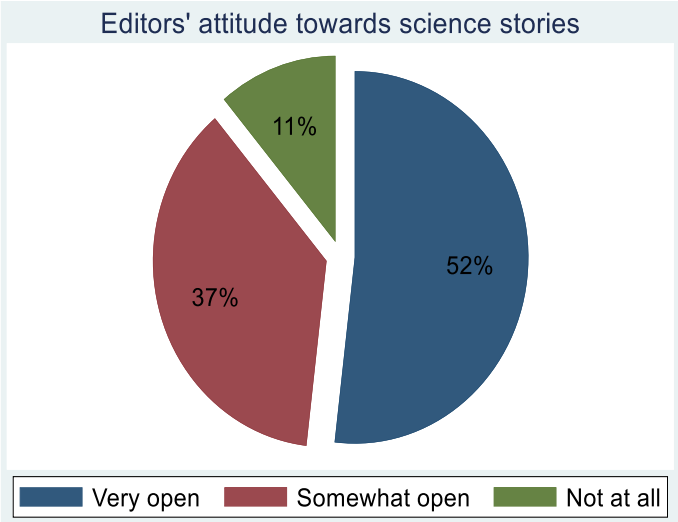
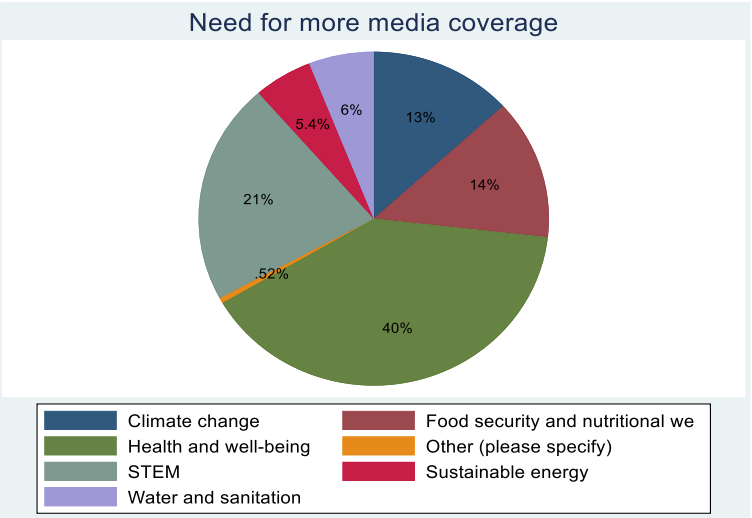


Figure 16. Presence of a science desk and a science editor

On assessing the presence of a science desk and/or a science editor in the media houses of the participating journalists, we found that 42% had a science desk and 37% had a science editor while 13% had neither a science desk nor a science editor. (see figure 16)

Those who answered 'not applicable' are journalists who did not cover science stories.





The attitude of science editors to receiving science stories was reported as ‘very open’ by 52% of the journalists. The plurality of journalists (40%) thought that health and well-being needed more media coverage, followed by STEM, and then food security and nutritional well-being.

Scientists

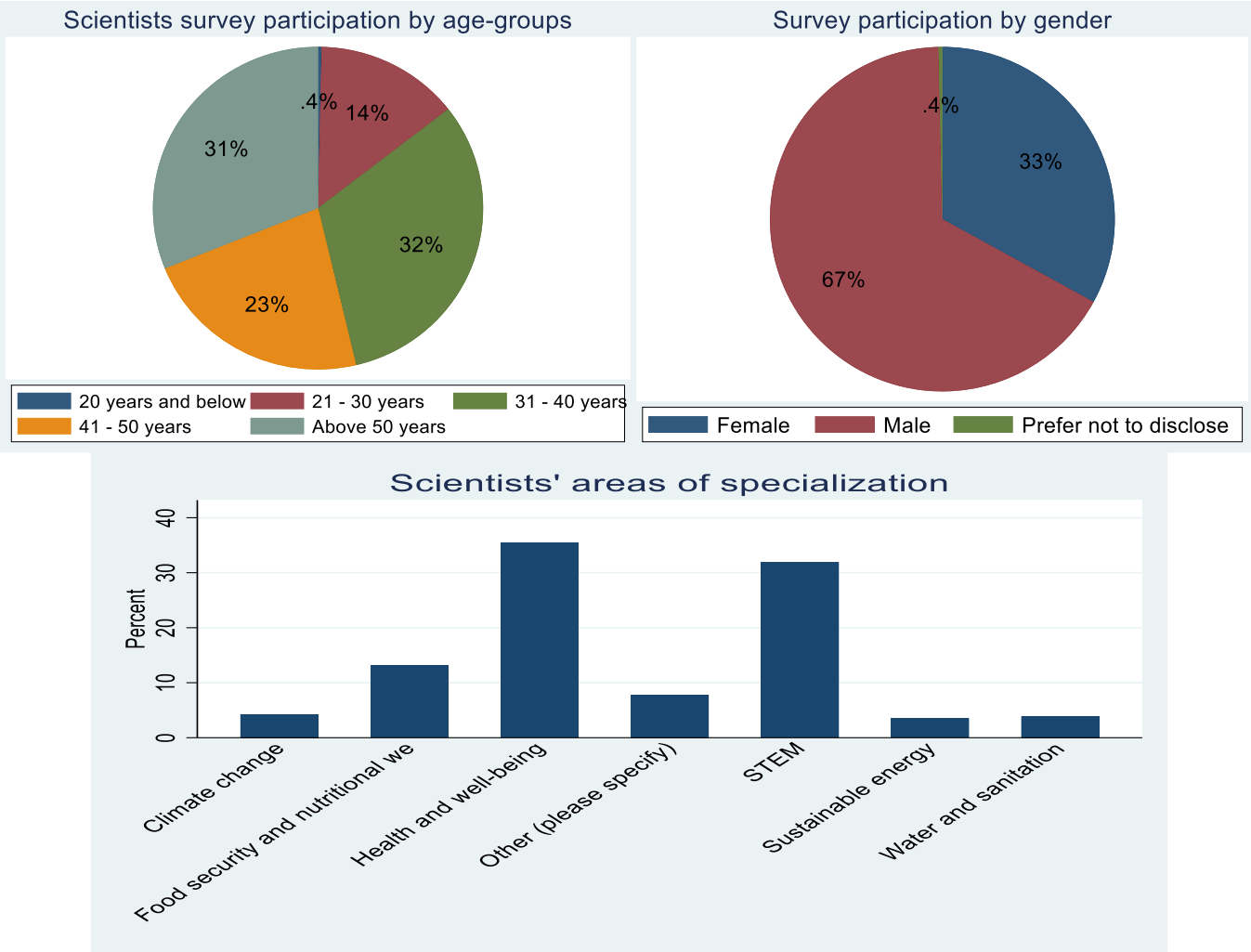


Figure 17. Demographic representation of scientists in the online survey

Of scientists responding to the online survey, 32% were 31-40 years old, and 31% were above 50 years old. 67% were male. Representation by area of specialization indicated that the plurality of scientists were in the fields of health and well-being and STEM. (see figure 17)

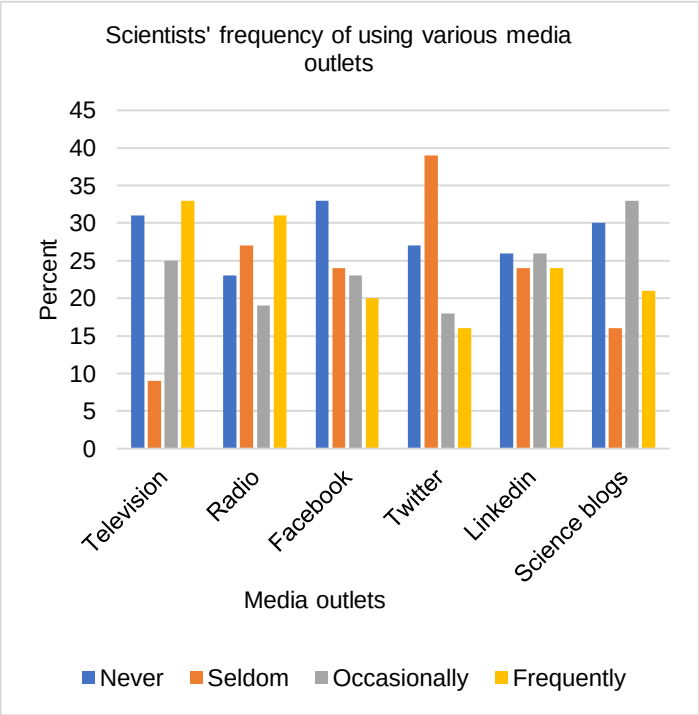


Figure 19a. Scientists' frequency of using various media outlets

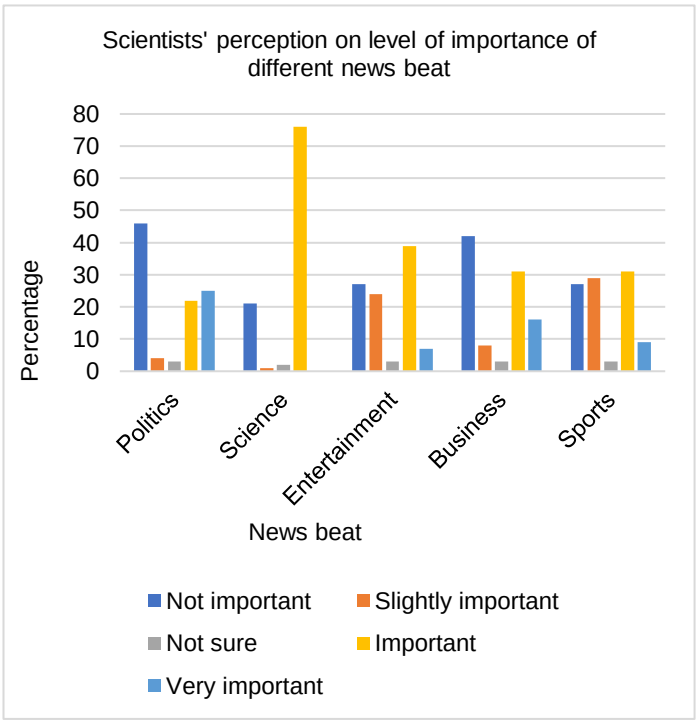


Figure 19b. Scientists' perception on level of importance of different news beat

Results indicate that scientists preferred television and radio to access science stories in the media as opposed to social media channels (see figure 19). 76% rated science as an important newsbeat; their ratings for other newsbeats ranged from 25-38% (see figure 18).

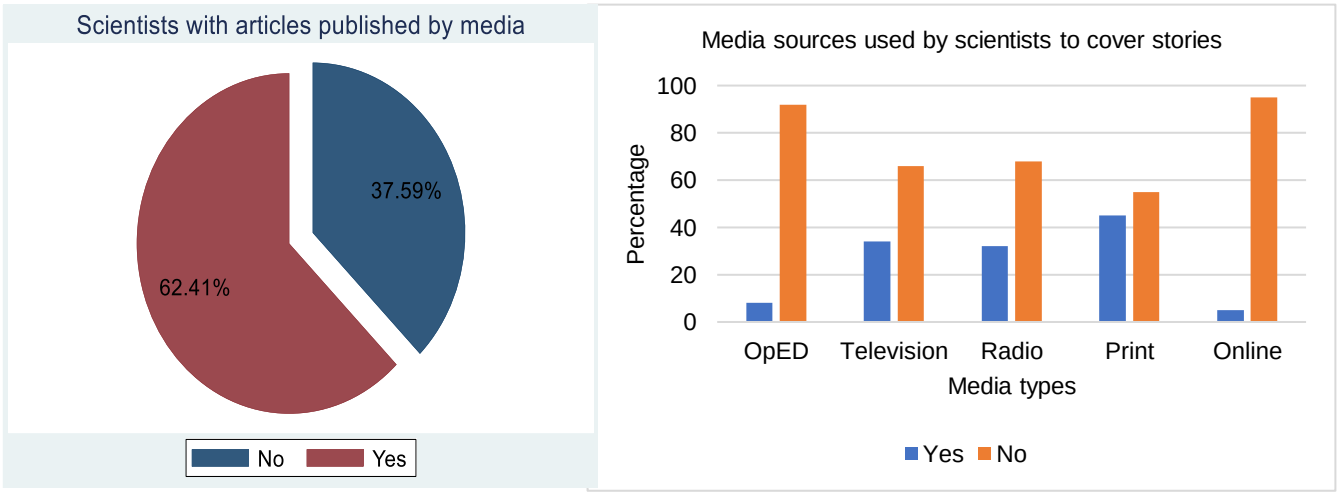


Figure 20. Scientists with articles published in media and media platforms used.

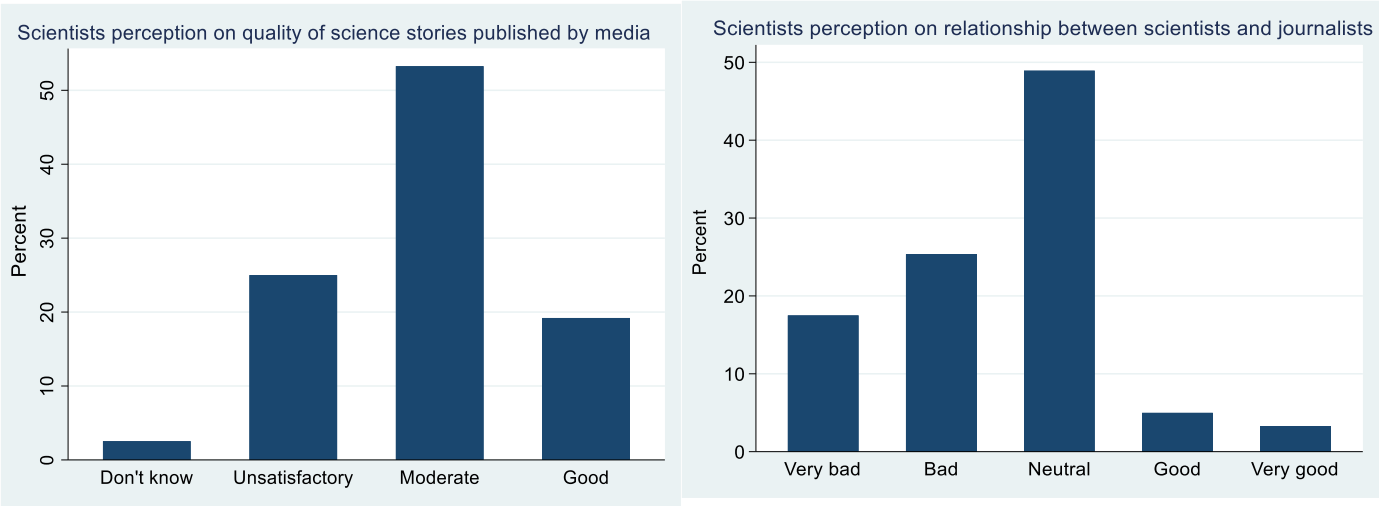


Figure 21. Scientists perceptions on quality of science stories published by media and the relationship between scientists and journalists

The survey assessed the perception of scientists of the quality of science stories in the media, and the relationship between scientists and journalists. Results indicate that most scientists (53%) perceived the quality of science stories as moderate, and 25% as unsatisfactory, while only 18% considered the quality of science stories in media as good. The plurality (48%) of scientists perceived the relationship between scientists and journalists as neutral, with the curve gradient leaning toward bad and very bad (25% and 18% respectively) (see figure 21).

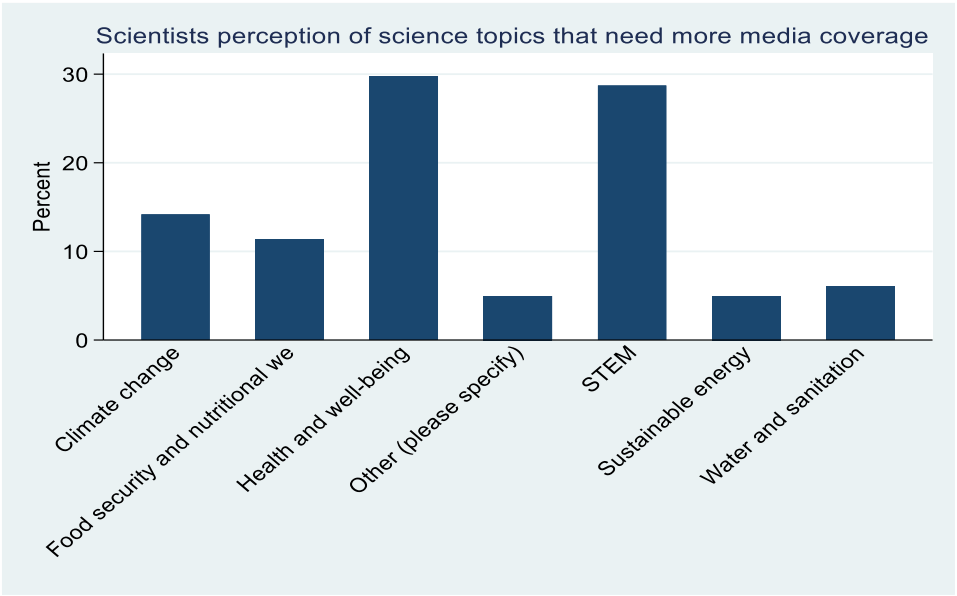


Figure 22. Scientists perception of science focus areas that need more media coverage

Most scientists indicated that health and well-being and STEM focus areas needed more media coverage.

Media Monitoring

Science stories published

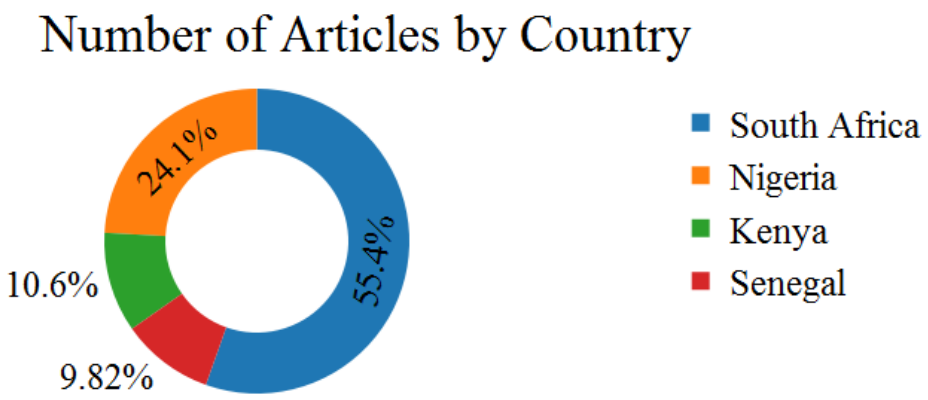


Figure 23. Distribution of science stories by country

In figure 23 above, of the 1741 science articles obtained from the Meltwaters database, 55.4% of them were from South Africa, followed by 24.1%,10.6% and 9.82% from Nigeria, Kenya and Senegal, respectively.

Data suggests that science stories are published relatively more in South Africa compared to the other countries. Awareness is therefore needed in the other countries on the need to publish more science stories.

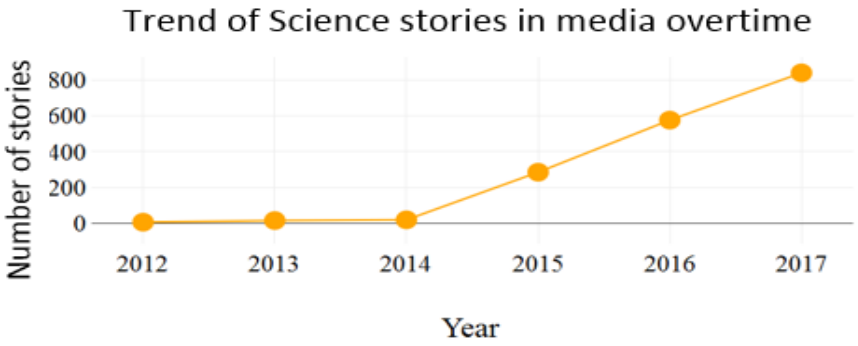


Figure 24: Science stories published overtime

Figure 24 above indicates that the overall trend of science stories published in the four contries increased exponentially overtime from the year 2014. The steep trend could imply an increase in interest among journalists to publish science stories, increase in the output of science, or better funding for science journalisms, or increased collaboration between scientists and journalists.

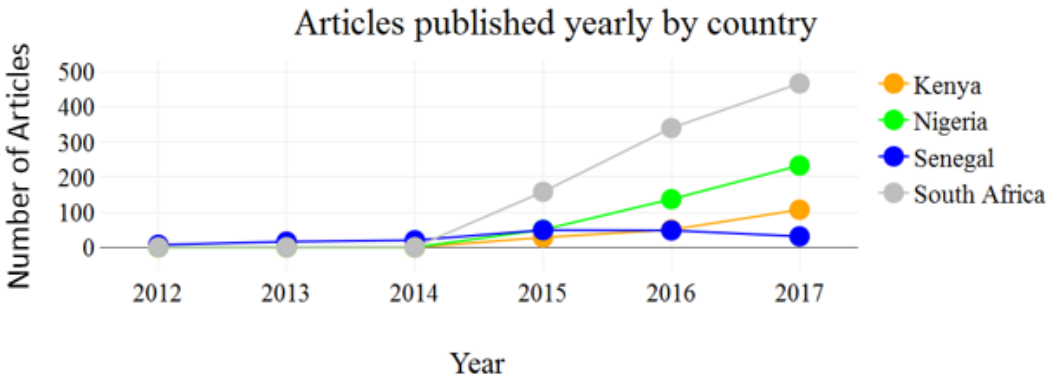


Figure 25: Trend of science stories published overtime in each country

Figure 25 shows that in all four countries, the output of science stories surged in 2014. The trend was dramatic in South Africa, moderate in Nigeria and Kenya, and low in Senegal. A lot therefore needs to be done to empower both journalists and scientists in Africa to take initiative in publishing science stories.

Focus areas covered by science stories – AAS cluster

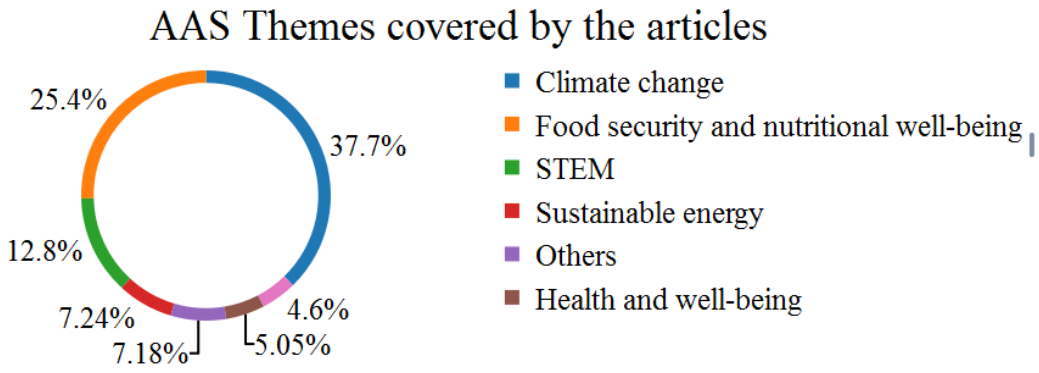


Figure 26: AAS themes covered by science stories

Of the 1741 articles obtained from the Meltwaters database, climate change was the major topic discussed, representing 37.7% of all the articles. These were followed by food security and nutritional well-being, at 25.4%. Articles that addressed STEM (12.8%), sustainable energy (7.24%) and health and well-being (5.1%) were also represented. About 4.6% of all the articles couldn't be classified in any of the AAS clusters.

This suggests that more needs to be done to empower scientists and science journalists to increase media coverage in STEM, sustainable energy and health and well-being.

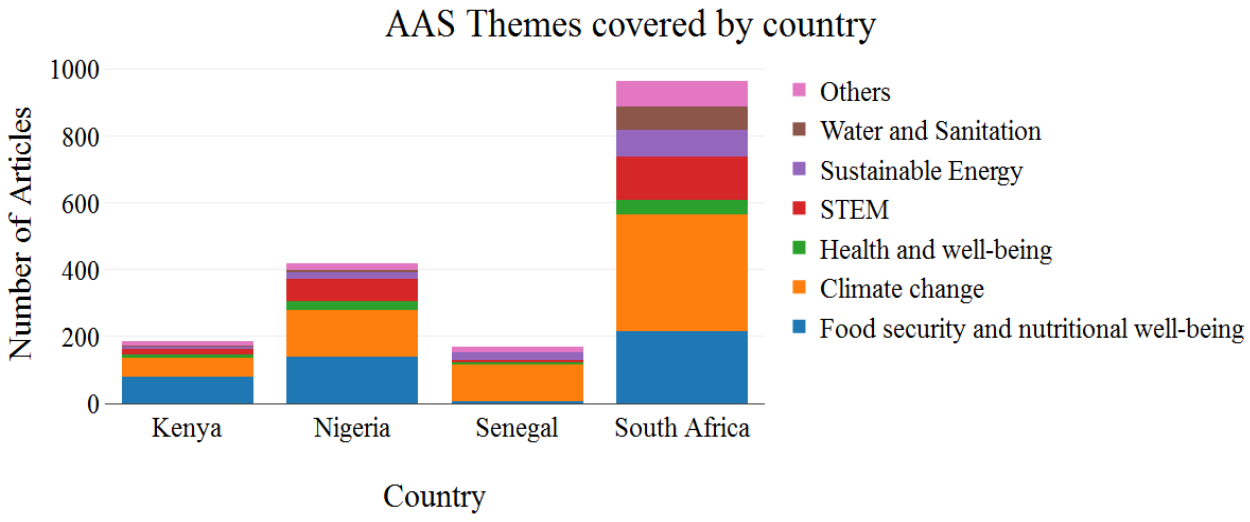


Figure 27: AAS themes covered by country

Figure 5 above shows that articles on climate change were most frequent across the four countries, with South Africa having the most, and Kenya the least. Senegal had a significantly lower number of articles on food security and nutritional well-being compared to the other countries. This suggests that governments need to foster collaboration with scientists and science journalists to identify gaps in media coverage.

Major sections in media platforms where science stories are featured

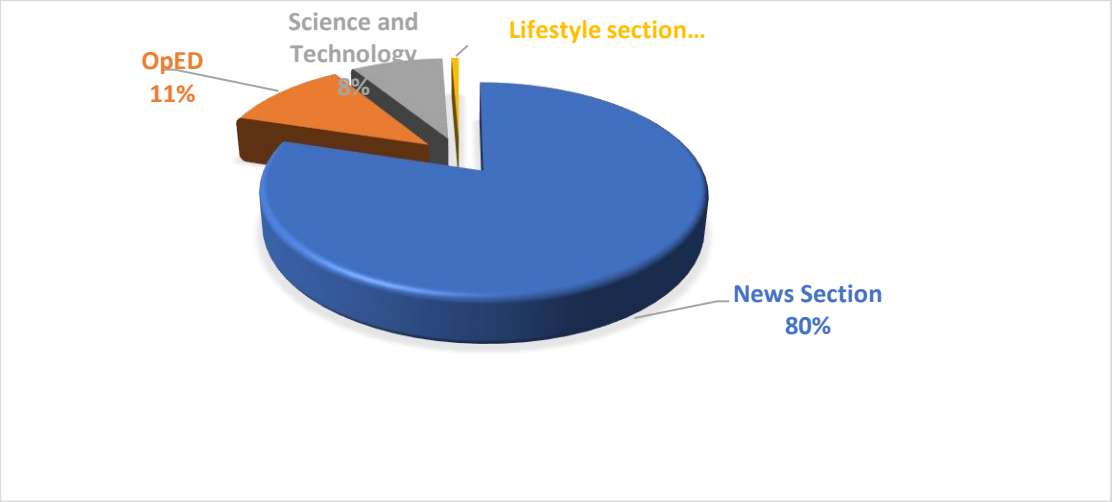


Figure 28: Major sections where articles featured

Figure 28 above shows that the majority (80%) of the stories were featured in the news section. This was followed by the Opinion-Editorial (OpED) section at 11%. Science and Technology and Lifestyle sections represented at 8% and 1%, respectively.

Major publications with science stories

Kenya

Figure 29 indicates that the top five sources of science stories in Kenya were:

- Coastweek
- Standard Digital News
- Daily Nation
- Mediamax Network
- ILRI News.

Figure 29: Sources of science stories in Kenya

Nigeria

Figure 30 indicates that the top five sources of science stories in Nigeria were:

- Uncova.com
- The Guardian Nigeria
- Nigeria Sun
- The Nation Newspaper Nigeria
- Vanguard

Figure 30: Sources of science stories in Nigeria

Senegal

Figure 31 indicates that the top five sources of science stories in Senegal were:

- Agence de Presse Sénégalaise
- Le Soleil
- Press Afrik
- African Press Agency
- Le Quotidien

Figure 31: Sources of science stories in Senegal

South Africa

Figure 32 indicates that the top five sources of science stories in South Africa were:

- Bizcommunity.com
- IOL
- News24
- B4F4
- Agri Portal South Africa

Figure 32: Sources of science stories in South Africa

Discussion and Conclusion

The field surveys indicate that the public is generally declined to rate the level of importance they attach to science stories in media, whereas the online surveys indicate that the public considered science stories to be very important. Upon examination of the data, it would appear that these findings can be attributed to the greater number of respondants to the online survey. If those results are projected onto the results for the general public, results would be similar.

The majority of the general public with basic and o-level education reported reading science stories. The media through which they most commonly consumed science content are newspapers and radio. Science journalists should be encouraged to increase science coverage in these media. The attitude of the public in Kenya, Nigeria, and Senegal towards science stories was neutral, while for those in Nigeria was positive.

Of the journalists who reported covering science stories, 60% did not have a science background. This calls for increased training of science journalists in order to build their capacity and increase accuracy and efficiency of covering science in media.

It was noted that science journalists are few on the Continent, attributed by respondents to poor remuneration compared to that of journalists covering other newsbeats. But findings indicate that journalists who cover science stories reported better pay than their colleagues on other beats. On further research, we found that the discrepancy can be explained by opportunities to freelance for other media organisations besides their primary one. This would be consistent with the low proportion of dedicated science journalism teams compared to teams dedicated to other beats. Strategies to improve remuneration of science journalists at their primary organisations should be implemented to encourage more scientists to explore the science niche and increase coverage of science in the media. It was encouraging to find that the attitude of editors towards science stories was very open.

Scientists rated the quality of science stories in the media as moderate, leaning towards unsatisfactory. Moreover, the relationship between journalists and scientists was reported as neutral, leaning towards negative. This relationship must be improved to increase collaboration between scientists and journalists to develop science stories. This, coupled with the capacity building of science journalists, would improve quality and quantity of science covered by media.

The majority of the journalists who participated in the online survey agreed that science was not well covered by the media. Most members of the public felt that health and well-being, water and sanitation, and food security and nutritional well-being needed more media coverage. In addition, journalists and scientists felt that STEM also needed more science coverage.

Challenges experienced by science journalists

i. Lack of basic training in science, inability to understand topical issues in science and lack of cooperation from scientists who lack a sense of what is newsworthy
ii. Poor funding to do research and write stories
iii. The media outlets not giving science enough importance
iv. The unresponsiveness and hostility from scientists towards the media
v. Lack of grasp by the chief editor on the importance of science reporting thus leading to other news beats taking precedence in the newsrooms
vi. Poor remuneration for complex topics that require a lot of research
vii. No opportunity for in depth coverage due to space constraints
viii. Few media outlets to pitch to
ix. The use of complex technical jargon by scientists or scientific terminologies that by themselves do not constitute “Science Communication”.
x. As an editor, poor pitching from writers
xi. Poor relationship between scientists and journalists
xii. Limited and very competitive opportunities for science journalists to advance their career compared to journalists covering other newsbeats. This has been attributed to lack of support and goodwill from chief editors in media outlets. As a result, most science journalists tend to leave media houses for other opportunities such as communication, public relations and project management.

Journalists suggestions on ways to improve science coverage in the media

i. Creating awareness among scientists on why the media is an important tool to disseminate their findings. These would in-turn mean they churn out more content to the media ...maybe then media houses would take the issues more seriously
ii. Provide science journalists with finances to go on field trips for on-the-field reports and investigative reports for better stories
iii. Build capacity of journalists through training opportunities

Scientists’ suggestions on ways to improve the quality of science reporting in media

i. Ensuring transparency is at the core of each storytelling and not bending the truth for popularity or concealing of critical information.

ii. Training of scientists on science communication to non-scientists
iii. Journalists working closely with scientists to develop science reporting
iv. Scientists and journalists must work together to avoid one-way direction of communication that limit exchange of ideas between non-scientists and scientists. In addition, working collaboration between scientists and journalists will ensure providing of information that will be more detailed, accurate and easily understood by the general public.
v. Creating synergistic platforms for scientists and journalists to interact with one another. Both parties would require some skill to understand the work ethics and language of one another.

Trainings suggested by science journalists

i. Training in basics of science and science reporting as well as topical issues in science e.g. biotechnology and climate science
ii. Interpretation of scientific research
iii. Data mining for public good
iv. Science and the media
v. Skills in gathering, assessing, preparing and presenting content in accurate and appealing way: in humanising science; in making people feel and see themselves in science, in presenting science stories in a way that helps people make informed choices

Funding source
Bill and Melinda Gates Foundation under the Africa Science Desk project.

REFERENCES

1. Cook, G., E. Pieri, and P.T. Robbins, *'The scientists think and the public feels': Expert perceptions of the discourse of GM food.* Discourse & Society, 2004. **15**(4): p. 433-449.
2. Bauer, M.W., et al., *Global science journalism report: working conditions & practices, professional ethos and future expectations*. 2013: Science and Development Network.
3. Irwin, A., *'Science Journalism 'Flourishing' in Developing World'*. 2009.
4. Corley, E.A., Y. Kim, and D.A. Scheufele, *Leading US nano-scientists' perceptions about media coverage and the public communication of scientific research findings.* Journal of Nanoparticle Research, 2011. **13**(12): p. 7041-7055.
5. Colson, V., *Science blogs as competing channels for the dissemination of science news.* Journalism, 2011. **12**(7): p. 889-902.
6. Rooyen, C.v., *'A Report on Science and Technology Coverage in the SA Print Media'. Foundation for Education, Science and Technology.* . 2002, University of Stellenbosch: South Africa.
7. *UNESCO Science Report: Towards 2030*. 2015: Paris.
8. Antilla, L., *Climate of scepticism: US newspaper coverage of the science of climate change.* Global Environmental Change, 2005. **15**(4): p. 338-352.
9. Larsson, A., et al., *Medical messages in the media–barriers and solutions to improving medical journalism.* Health expectations, 2003. **6**(4): p. 323-331.
10. Leiserowitz, A.A., *American risk perceptions: Is climate change dangerous?* Risk analysis, 2005. **25**(6): p. 1433-1442.
11. Liu, X., A. Vedlitz, and L. Alston, *Regional news portrayals of global warming and climate change.* environmental science & policy, 2008. **11**(5): p. 379-393.
12. Chyi, H.I. and M. McCombs, *Media salience and the process of framing: Coverage of the Columbine school shootings.* Journalism & Mass Communication Quarterly, 2004. **81**(1): p. 22-35.
13. McLeod, J.M., L.B. Becker, and J.E. Byrnes, *Another look at the agenda-setting function of the press.* Communication research, 1974. **1**(2): p. 131-166.
14. Atwater, T., M.B. Salwen, and R.B. Anderson, *Media agenda-setting with environmental issues.* Journalism Quarterly, 1985. **62**(2): p. 393-397.
15. Edwards III, G.C., W. Mitchell, and R. Welch, *Explaining presidential approval: The significance of issue salience.* American Journal of Political Science, 1995: p. 108-134.
16. Soroka, S.N., *Media, public opinion, and foreign policy.* Harvard International Journal of Press/Politics, 2003. **8**(1): p. 27-48.
17. McCombs, M.E. and D.L. Shaw, *The agenda-setting function of mass media.* Public opinion quarterly, 1972. **36**(2): p. 176-187.
18. Cook, F.L., et al., *Media and agenda setting: Effects on the public, interest group leaders, policy makers, and policy.* Public Opinion Quarterly, 1983. **47**(1): p. 16-35.
19. Wanta, W., G. Golan, and C. Lee, *Agenda setting and international news: Media influence on public perceptions of foreign nations.* Journalism & Mass Communication Quarterly, 2004. **81**(2): p. 364-377.
20. Trumbo, C., *Constructing climate change: claims and frames in US news coverage of an environmental issue.* Public understanding of science, 1996. **5**: p. 269-283.
21. Cook, T.E., *Governing with the news: The news media as a political institution*. 1998: University of Chicago Press.
22. Norris, P., *A virtuous circle: Political communications in postindustrial societies*. 2000: Cambridge University Press.
23. Hargreaves, I., J. Lewis, and T. Speers, *Towards a better map: Science, the public and the media*. 2003: Economic and Social Research Council Swindon.
24. Schudson, M., *The Power of News (Cambridge.* Mass.: Harvard University, 1995.
25. Antilla, L., *Self-censorship and science: a geographical review of media coverage of climate tipping points.* Public Understanding of Science, 2010. **19**(2): p. 240-256.

26. McComas, K. and J. Shanahan, *Telling stories about global climate change: Measuring the impact of narratives on issue cycles.* Communication Research, 1999. **26**(1): p. 30-57.
27. Weingart, P., *Die Wissenschaft der Öffentlichkeit: Essay zum Verhältnis von Wissenschaft, Medien und Öffentlichkeit.* 2005.
28. Nisbet, M.C. and C. Mooney, *Science and Socity. Framing Science.* Science, 2007. **316**.
29. Nisbet, M.C. and D.A. Scheufele, *What's next for science communication? Promising directions and lingering distractions.* American journal of botany, 2009. **96**(10): p. 1767-1778.
30. DiBella, S.M., A.J. Ferri, and A.B. Padderud, *Scientists' reasons for consenting to mass media interviews: A national survey.* Journalism Quarterly, 1991. **68**(4): p. 740-749.
31. Weigold, M.F., *Communicating science: A review of the literature.* Science communication, 2001. **23**(2): p. 164-193.
32. Petersen, A., et al., *Opening the black box: scientists' views on the role of the news media in the nanotechnology debate.* Public Understanding of Science, 2009. **18**(5): p. 512-530.
33. Mathews, D.J., A. Kalfoglou, and K. Hudson, *Geneticists' views on science policy formation and public outreach.* American Journal of Medical Genetics Part A, 2005. **137**(2): p. 161-169.
34. Gascoigne, T. and J. Metcalfe, *Incentives and impediments to scientists communicating through the media.* Science Communication, 1997. **18**(3): p. 265-282.
35. Maillé, M.-È., J. Saint-Charles, and M. Lucotte, *The gap between scientists and journalists: the case of mercury science in Québec's press.* Public Understanding of Science, 2010. **19**(1): p. 70-79.
36. Davies, S.R., *Constructing communication: Talking to scientists about talking to the public.* Science Communication, 2008. **29**(4): p. 413-434.
37. Mellor, F., *Negotiating uncertainty: Asteroids, risk and the media.* Public understanding of science, 2010. **19**(1): p. 16-33.
38. Geller, G., et al., *Scientists' and science writers' experiences reporting genetic discoveries: Toward an ethic of trust in science journalism.* Genetics in Medicine, 2005. **7**(3): p. 198.
39. Moore, B. and M. Singletary, *Scientific sources' perceptions of network news accuracy.* Journalism Quarterly, 1985. **62**(4): p. 816-823.
40. De Boer, M., et al., *Public understanding of food risk issues and food risk messages on the island of Ireland: the views of food safety experts.* Journal of food safety, 2005. **25**(4): p. 241-265.
41. Krystallis, A., et al., *A perceptual divide? Consumer and expert attitudes to food risk management in Europe.* Health, Risk & Society, 2007. **9**(4): p. 407-424.
42. Burchell, K., *Empiricist selves and contingent "others": The performative function of the discourse of scientists working in conditions of controversy.* Public Understanding of Science, 2007. **16**(2): p. 145-162.
43. Burningham, K., et al., *Industrial constructions of publics and public knowledge: A qualitative investigation of practice in the UK chemicals industry.* Public Understanding of Science, 2007. **16**(1): p. 23-43.
44. Young, N. and R. Matthews, *Experts' understanding of the public: Knowledge control in a risk controversy.* Public Understanding of Science, 2007. **16**(2): p. 123-144.
45. Blok, A., M. Jensen, and P. Kaltoft, *Social identities and risk: expert and lay imaginations on pesticide use.* Public understanding of science, 2008. **17**(2): p. 189-209.
46. Moore, A. and J. Stilgoe, *Experts and Anecdotes: The Role of "Anecdotal Evidence" in Public Scientific Controversies.* Science, Technology, & Human Values, 2009. **34**(5): p. 654-677.

47. Michael, M. and N. Brown, *From the representation of publics to the performance of'lay political science'.* Social Epistemology, 2000. **14**(1): p. 3-19.
48. Trust, M.W., *The role of scientists in public debate.* 2001.
49. Michael, M. and L. Birke, *Enrolling the core set: The case of the animal experimentation controversy.* Social Studies of Science, 1994. **24**(1): p. 81-95.
50. Chapman, G., *Environmentalism and the Mass Media: The North--South Divide*. 1997: Psychology Press.
51. Gunther, A.C., *The persuasive press inference: Effects of mass media on perceived public opinion.* Communication Research, 1998. **25**(5): p. 486-504.
52. Viswanath, K., *The communications revolution and cancer control.* Nature reviews cancer, 2004. **5**(10): p. 828.
53. Dutta-Bergman, M.J., *Primary sources of health information: Comparisons in the domain of health attitudes, health cognitions, and health behaviors.* Health communication, 2004. **16**(3): p. 273-288.
54. Brown, J.D. and K. Walsh-Childers, *Effects of media on personal and public health.* Media effects: Advances in theory and research, 2002. **2**: p. 453-488.
55. Smedley, B.D. and M.A. Haynes, *The unequal burden of cancer: an assessment of NIH research and programs for ethnic minorities and the medically underserved*. 1999: National Academies Press.
56. Amzel, A. and C. Ghosh, *National newspaper coverage of minority health disparities.* Journal of the National Medical Association, 2007. **99**(10): p. 1120.
57. Quora. *Quora*. Available from: https://www.quora.com/.

Appendix 1: Content Analysis Coding Sheet

VARIABLE NAME	VARIABLE LABEL	INSTRUCTIONS AND CODING VALUES	CODE Initials on names of coder
ID		Number with the coder's unique ID	
Coder	Coder's first name	Enter as string variable	
Date1	Date of coding	Enter as dd/mm/yy	
Country	Country in which the article was published	Kenya Nigeria Senegal South Africa	
Date2	Date of publication	Enter as dd/mm/yy	
Newspaper	Name of newspaper	Enter as string variable	
Headline	Story headline	Enter as string variable	
Section	Section where article appears	1= News Section 2= OpED 3= Science and Technology section 5= Lifestyle section 6= Entertainment section 4= Other	
OtherSec	Specify section selected as other	Enter as string variable	
Writer	The person who wrote the story	Enter name of person or group. If person, enter position or title and agency/institutional affiliation.	
Number of sources/interviewees/experts in the story	Number of sources	Enter a value	
Science experts	Are the sources scientists?	Yes/No	
Type of story		Press release Interview Scientific findings Other	
OtherType			

Science category	Which science category does the story fit in?	Health and well-being Climate change Food security and nutritional well-being Water and sanitation Sustainable energy STEM Other	
Sentiments		Positive Neutral Negative	
Word count		Enter a value	