Check for updates

DATA NOTE

Data Note: COVID-19, social distancing, and pipeline vandalism in Nigeria [version 1; peer review: 2 not approved]

P. N. Onwuachi-Iheagwara¹ , B.I Iheagwara²

¹Department of Petroleum Engineering, Delta state university, Oleh, Delta, Nigeria

²Independent researcher, Unaffiliated, Warri, Delta state, Nigeria

v1 First published: 19 Jul 2021, 10:604
<https://doi.org/10.12688/f1000research.54315.1>

Latest published: 20 Dec 2022, 10:604
<https://doi.org/10.12688/f1000research.54315.2>

Abstract

We present a dataset of the monthly cases of pipeline vandalism in Nigeria from January 2015 to January 2021. Data used in this study were collated from the Monthly Financial and Operations Reports (MFOR) of the Nigeria National Petroleum Corporation (NNPC). Each MFOR provides cases of pipeline vandalism during a 12-month span from five key locations; Mosimi, Kaduna, Port Harcourt, Warri, and Gombe. Recorded incidences of pipeline vandalism from these locations were summed and assembled into five groups; namely: historical data, prior-COVID-19, COVID-19 lockdown, and post-COVID-19 lockdown. The data were grouped based on dates. These dates were January 2015 to July 2019, August 2019 to January 2020, February 2020 to July 2020, and August 2020 to January 2021 respectively. The historical data were further sub-divided into four sub-groups based on the deployment (May 2016) of sophisticated weapons, satellite imagery, and geographical information system into the security apparatus to checkmate pipeline vandalism. The four sub-groups are sub-group A (one-year before deployment), sub-group B (the year of deployment), sub-group C (one-year after deployment), and sub-group D (two-years after deployment). The dates span for each sub-group is May 2015-April 2016, May 2016-April 2017, May 2017-April 2018, and May 2018-April 2019 respectively. After the deployment of GIS devices in May 2016, the accumulated national number of pipeline vandalism cases declined from 400 cases in January 2016 to 293 in February 2016, and 259 cases in March 2016 as opposed to 60, 49, and 94 cases in the same months in 2017; but over the years, 2017 to 2021 these methods have proved less effective, and cases of pipeline vandalism have risen once more. Similar changes in the number of cases and patterns were observed during the COVID-19 movement restrictions. From the dataset, it can be seen that COVID-19 influenced incidences of pipeline vandalism.

Keywords

COVID-19, pipeline vandalism, restriction on movement, NNPC pipelines, pipes

Open Peer Review

Approval Status

	1	2
version 2		
(revision)		
20 Dec 2022		
version 1		
19 Jul 2021		

1. **Alessandro Rovetta** , R&C Research, Bovezzo (BS), Italy

2. **Nima Khakzad** , Ryerson University, Toronto, Canada

Any reports and responses or comments on the article can be found at the end of the article.

This article is included in the **Sociology of Health** gateway.

This article is included in the **Coronavirus** collection.

Corresponding author: P. N. Onwuachi-Iheagwara (pniheagwara@gmail.com)

Author roles: **Onwuachi-Iheagwara PN:** Conceptualization, Formal Analysis, Investigation, Methodology, Validation, Visualization, Writing – Original Draft Preparation, Writing – Review & Editing; **Iheagwara BI:** Formal Analysis, Methodology, Validation, Writing – Review & Editing

Competing interests: No competing interests were disclosed.

Grant information: The author(s) declared that no grants were involved in supporting this work.

Copyright: © 2021 Onwuachi-Iheagwara PN and Iheagwara BI. This is an open access article distributed under the terms of the **Creative Commons Attribution License**, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

How to cite this article: Onwuachi-Iheagwara PN and Iheagwara BI. **Data Note: COVID-19, social distancing, and pipeline vandalism in Nigeria [version 1; peer review: 2 not approved]** F1000Research 2021, 10:604 <https://doi.org/10.12688/f1000research.54315.1>

First published: 19 Jul 2021, 10:604 <https://doi.org/10.12688/f1000research.54315.1>

Introduction

Product theft and vandalism of national pipelines are recurring challenges faced by the Nigeria National Petroleum Corporation (NNPC).^{1,2} During the COVID-19 pandemic, movements were restricted. It is desirable to determine if a significant difference exists in the incidence of pipeline vandalism of Nigerian oil pipelines during the COVID-19 pandemic. This dataset provides that information.

Method

Incidences of vandalism of pipeline are ascribed in the Monthly Financial and Operations Reports (MFOR) of the Nigeria National Petroleum Corporation (NNPC).⁵ In this research, data from the NNPC MFOR from January 2015 to January 2021 were used. These monthly reports are available for free download by the public from the NNPC website link (NNPC; <https://www.nnpcgroup.com>).³ The information abstracted from the NNPC MFOR were number of cases of pipeline vandalism per month, month of vandalism, and year of vandalism.

The data were grouped into four groups, namely:

1. Historical data – 1st January 2015 to 31st July 2019.
2. Prior COVID-19 data – 1st August 2019 to 31st January 2020.
3. COVID-19 data – 1st February 2020 to 31st July 2020.
4. Post COVID-19 data – 1st August 2020 to 31st January 2021.

Furthermore, we obtained information and dates of major events that may be considered possible external stimuli in this analysis. This information was collected from national and regional newspapers and web-based publications, and web pages.

These are:

- May 2016, incorporation and deployment of sophisticated weapons, use of satellite images and geographical information system (GIS) into the security apparatus to ensure vandalism is contained, the setting up of a pipeline security force to stamp out the menace, and the formation of the Trans-National Organized Crime (TNOC) with regional allies to fight against the proliferation of Small Arms and Light Weapons.⁴ This was a welcome development as the area under physical patrol were massive.
- The onset of COVID-19 in December 2019 and the declaration of COVID-19, on 30th January 2020, as a Public Health Emergency of International Concern by WHO (World Health Organization), and the upgrade to a pandemic by the 11th of March 2020.
- In Nigeria, the pre-lockdown commenced from 28th February – 29th March, 2020, and was 31 days in duration. The lockdown, in total 35 days; was from 30th March to 3rd May, 2020, and 'easing up' of 73 days, 5th May – 15th July, 2020.

This information was mainly used in the interpretation of the plot of monthly cases of pipeline vandalism vs. time in month/year (Figure 1).

The May 2016 event (from a cursory glance of Figure 1) had a great impact on cases of pipeline vandalism. Thus, the historical data were further divided into four sub-groups to capture the possible influence of the deployment in May 2016 by the Nigerian government on pipeline vandalism.⁴

The four sub-groups of the historical data are:

1. Sub-group A (one-year before deployment; 1st May 2015–30th April 2016),
2. Sub-group B (year of deployment; 1st May 2016–30th April 2017),
3. Sub-group C (one-year after deployment; 1st May 2017–30th April 2018),
4. And sub-group D (two-years after deployment; 1st May 2018–30th April 2019).

Figure 1. Plot of monthly cases of pipeline vandalism vs. time (month/year).

Prior to the deployment, the pipeline security method involved the active patrol in pipeline installation by security agents using patrol vehicles. Another method adopted by past administration was the involvement of local militia leaders in delicate but dangerous and remote locations. Subsequent to the deployment a combination of the active patrol of pipeline installation by security agents and GIS are used; in addition to a reversal of the policy on the use of local militia.⁴

Software used in the data analysis

The MS office Excel 2013 with the Analysis ToolPak add-in were used. In all statistical analysis in this project, an $\alpha = 0.05$ as the significance threshold was set, and a null and an alternative hypothesis were established. This means that the null hypothesis would be rejected if the p-value is less than or equal to 0.05 and the alternative hypothesis would be accepted.

COVID-19 groups

- **Null hypothesis:** There is no significant difference between the mean case of pipeline vandalism incidences prior, during, and post COVID lockdown.
- **Alternative hypothesis:** There is a significant difference between the mean case of pipeline vandalism incidences prior, during, and post COVID-19.

For the group data, the total incidences during the time frame covered by the group, average, and standard deviation were established. The grouped data were subjected to an ANOVA analysis, and a time series analysis was undertaken after the data were smoothed using a moving average.

Sub-groups

For the sub-groups, the total cases in each subgroup, the mean, and the standard deviation were calculated. A null and an alternative hypothesis were set.

- **Null hypothesis:** There is no significant difference between the mean case of pipeline vandalism incidences prior, during, and post the deployment.
- **Alternative hypothesis:** There is a significant difference between the mean case of pipeline vandalism incidences prior, during, and post the deployment.

The sub-grouped data were also subjected to an ANOVA analysis, and a time series analysis (after the data were smoothened by moving average).

Third, it was observed that fewer cases of vandalism occurred in the historical sub-group B than in any other subgroup with major improvements six months after the deployment in May 2016. The six-month lag may be the “learning/training and implementation phase” after the media announcements and deployment. In the COVID-19 pandemics groups, the lockdown period presented fewer cases of pipeline vandalism. It was noted that periods of renovations of the

Figure 2. Comparative analysis of pipeline vandalism after six months of renovations of the methodologies used by NNPC, and during six months of lock down.

methodologies used to checkmate the activities of vandals and uncompromising movement restrictions favoured a reduction in cases of pipeline vandalism. From a security viewpoint, it was therefore desirable to determine if greater success would be attributed to the use of either of the two methods (Figure 2). This would enable the government to design a more winning approach to vandalism.

Dataset validation

Allowances made to control bias or unwanted sources of variability

Seasonal confounds

There are two principal seasons, the wet rainy season and the hot dry season in Nigeria. Pipeline vandalism takes place in remote locations on isolated, rural roads and footpaths; not readily accessible during adverse weather conditions. We, therefore, assume that the rainfall affects the number of cases of pipeline vandalism. However, rainfall patterns are fairly predictable and torrential rainfall occurs in the mid of the rainy seasons. Seasonal confounds were eliminated by comparing data for the same months in each group. This implies that the rainfall season data (in one group) were compared only with the rainfall season data (in another group); with similar arguments for the dry season data.

Data points in each group or sub-group

For all analysis, the number of data points was of uniform length to reduce any possible bias due to unparalleled data points.

In each COVID-19 group (prior, during, and post COVID-19 lockdown groups) the number of data points were six. In the four sub-groups of the historical data (i.e., sub-group A, sub-group B, sub-group C, and sub-group D) each sub-group had 12 data points.

The data was assembled over an even interval and ordered chronologically with equal time frequency.

Exclusion of data

All cases/incidences of vandalism of pipelines that fall before or after the time frame under review (1st January, 2015 to 31st January, 2021) as ascribed in the MFOR were removed from the analysis.

Other assumptions made

The destruction of these pipelines has been a scourge on the national petroleum industry in Nigeria since time immemorial,¹ two groups of people disrupt pipelines in Nigeria namely; activists, radicals, and militants, to make political statements, and thieves with the sole purpose to gain illegal possession of the fluids.

The former, makes political statements before any attempted disruptions, often to inform the government and allow negotiation for the fulfillment of their demands; the latter do not. During the lockdown, no activists, radicals, and militants made any political statement; so, we can assume they also heeded the order to isolate and social distance. We therefore attributed all pipeline vandalism during the COVID-19 lockdown period to thieves.

Results

Our dataset shows the monthly cases of pipeline vandalism from 2015 to 2021.⁵ It shows the variations in cases before and after the use of GIS for monitoring. It also revealed the changes in pre-COVID-19, post-COVID-19, and during the pandemic.

This dataset ensures the easy availability of this information for the general public.

Data availability

Underlying data

Harvard Dataverse. Effects of COVID-19 on pipeline vandalism in Nigeria, West Africa. DOI: <https://doi.org/10.7910/DVN/8X5KKB>.⁵

This project contains the following underlying data:

Dataset Data for: Effects of COVID-19 on pipeline vandalism ingested files:

- Original data.tab. (Contains the unfiltered data from the NNPC reports, with cases of pipeline vandalism tabulated by month and year.).
- ANOVA-Historical subgroups.tab. (Two sheets. One; (MasterDataSheet) contains the original data divided into the four groups and a second (Historical sub-groups) preliminary analyses on the sub-groups).
- ANOVA-COVID-19 groups.tab. (ANOVA analysis of COVID-19 group (prior, during, and post COVID-19 lockdown groups)).
- Graph-subgrpB-and-6-months lockdown.tab. (Comparative analysis of key periods – 1st February-30th July 2017 and 1st February-30th July 2020).
- Time series analysis -COVID-19 groups.tab. (Time series analysis of COVID-19 group (prior, during, and post COVID-19 lockdown groups) smoothening with moving average).
- Time series analysis-Historical subgroups.tab. (Time series analysis of historical subgroups with smoothening by moving average).

Data are available under the terms of the [Creative Commons Zero “No rights reserved” data waiver](#) (CC0 1.0 Public domain dedication).

References

1. Mmeje DU, Bello A, Mohammed UD: **Investigation of Pipeline Vandalism and Its Implications on Business Activities in Nigeria**. *Journal of Resources Development and Management* www.iiste.org. 2017; 2422-8397. An International Peer-reviewed Journal, Vol. **38**, 2017.
2. Okoli A, Chukwuma, Orinya S: **Oil Pipeline Vandalism and Nigeria's National Security**. *Global Journal of human social science Political Science*. 2013; Volume **13** Issue 5 Version 1.0 Year 2013, Online ISSN: 2249-460x & Print ISSN: 0975-587X

3. The NNPC group.
[Reference Source](#)
4. **Buhari's Milestones in One Year – Presidency.**
[Reference Source](#) Downloaded 10th May 2021
5. Onwuachi-Iheagwara N: **Data for: Effects of COVID-19 on pipeline vandalism in Nigeria, West Africa.** *Harvard Dataverse, V1, UNF:6: oZ02Sff1pmG9M3ThLAQNFw== [fileUNF].* 2021.
[Publisher Full Text](#)

Open Peer Review

Current Peer Review Status:

Version 1

Reviewer Report 11 January 2022

<https://doi.org/10.5256/f1000research.57792.r115417>

© 2022 Khakzad N. This is an open access peer review report distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Nima Khakzad

School of Occupational and Public Health, Ryerson University, Toronto, Ontario, Canada

The authors have assessed the influence of satellite/GIS equipment and the COVID-19 lockdown on the number of pipeline vandalism events in Nigeria. In general, the employed technique is oversimplified, and the research outcomes are too obvious to warrant a novel/innovative study. From a methodological perspective, regarding the deployment of satellite/GIS equipment and restriction of social activities due to the COVID-19 lockdown as two independent variables and the number of pipeline vandalism events as the only dependent variable, the authors should have employed a multi-variable correlation analysis rather than two separate single-variable correlation analysis, at least from the onset of the lockdown onwards.

Furthermore, the results of the study are too obvious to justify the necessity of the research. That the deployment of monitoring measures and the COVID-19 lockdown have had a negative impact on the number of the vandalism events was predictable even with a glimpse on the raw data in Figure 1.

Below are some more comments:

- In the abstract, the data is said to have been assessed in 5 groups, but only 4 groups have been named. Please correct this.
- Under "other assumptions made", 2 groups of people are said to be involved in pipeline vandalism, but three groups are named. Please correct this.
- In the abstract, it should be pointed out, as one of the main outcomes of the study, why the number of pipeline vandalisms rose again in 2017 despite all the security and satellite measures.
- Use of acronyms/abbreviations in the Keywords is not recommended. (NNPC in this case). Besides, the keywords "pipeline" and 'pipes' are too close to be considered two different keywords.

- The vertical lines marked on Figure 1 need to be in different colors with a legend provided to decode the colors. In the current form, except the first line which denotes the deployment of satellite/GIS equipment, the other lines are not clear to mark which significant event/date.

Is the rationale for creating the dataset(s) clearly described?

Yes

Are the protocols appropriate and is the work technically sound?

No

Are sufficient details of methods and materials provided to allow replication by others?

Yes

Are the datasets clearly presented in a useable and accessible format?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Safety Engineering; Cascading effects

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Reviewer Report 28 July 2021

<https://doi.org/10.5256/f1000research.57792.r89908>

© 2021 Rovetta A. This is an open access peer review report distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Alessandro Rovetta

R&C Research, Bovezzo (BS), Italy

General comments:

This paper investigates the impact of anti-COVID-19 restrictive measures on the vandalism pipeline by analyzing the time series of the incidence of the phenomenon from January 2015 to January 2021. To do this, an ANOVA is adopted after the data has been processed via a moving average. The authors conclude that COVID-19 influenced the incidences of pipeline vandalism. However, at present, there are numerous critical issues to be addressed before proceeding with indexing.

Major comments:

1) Section: Introduction. This section needs some additions to represent a complete background and contextualize the paper in the current scenario. Specifically, I suggest briefly discussing:

1.1. The incidence of pipeline vandalism in Nigeria and the related problems and damage (providing appropriate references)

1.2. The usefulness of this study (i.e., what kind of information can this type of analysis return regarding pipeline vandalism? Why is it relevant to evaluate the impact of anti-pandemic restrictions on the phenomenon?)

1.3. The significance of the paper for future research (i.e., how can this data note help government authorities deal with pipeline vandalism?)

2) Section: Methods.

2.1. *"These monthly reports are available for free download by the public from the NNPC website link (NNPC; <https://www.nnpcgroup.com>)"* To facilitate reproducibility, I kindly ask the authors to provide a more precise URL or path description to derive this dataset. Thank you.

2.2. *"The data were grouped into four groups, namely: [...]"* I strongly suggest motivating those subdivisions in detail. In particular, based on what criteria and purpose were these groups formed?

2.3. *"May 2016, incorporation and deployment of sophisticated weapons, use of satellite images and geographical information system (GIS) into the security apparatus to ensure vandalism is contained, the setting up of a pipeline security force to stamp out the menace, and the formation of the Trans-National Organized Crime (TNOC) with regional allies to fight against the proliferation of Small Arms and Light Weapons. 4"* Reference 4 refers to a web page called "Oil and Gas 360." Therefore, I kindly ask if it is possible to provide a more specific URL or refer to an academic source.

2.4. *"In Nigeria, the pre-lockdown commenced from 28th February – 29th March, 2020, and was 31 days in duration. The lockdown, in total 35 days; was from 30th March to 3rd May, 2020, and easing up' of 73 days, 5th May – 15th July, 2020."* This information needs a reference.

2.5. *"The May 2016 event (from a cursory glance of Figure 1) had a great impact on cases of pipeline vandalism."* Figure 1 shows that the decreasing trend has occurred since July 2016. Therefore, it is necessary to argue the causal nature of the association made and discuss the presence of a time-series lag.

2.6. *"In all statistical analysis in this project, an $\alpha = 0.05$ as the significance threshold was set, and a null and an alternative hypothesis were established. This means that the null hypothesis would be rejected if the p-value is less than or equal to 0.05 and the alternative hypothesis would be accepted."* Using a simple threshold for significance analysis is misleading (Amrhein *et al.* (2017)¹), Greenland *et al.* (2016)²). P-values should be used - at best - as a graded measure of the strength of evidence against the null hypothesis. Therefore it is necessary to report the P-values in full (if this is not possible, it is advisable to provide an additional file). Furthermore, P-values are unsuitable for

measuring the intensity of a phenomenon (e.g., very weak but statistically significant phenomena can occur (Schober *et al.* (2018³))). Therefore I suggest introducing quantifiers into the analysis (e.g., percentage differences).

2.7. *“The sub-grouped data were also subjected to an ANOVA, and a time series analysis (after the data were smoothed by moving average).”* ANOVA analysis requires the verification of a certain number of assumptions, as explained [here](#). Therefore, how the latter has been verified must be described in detail. Moreover, it is necessary to specify the type of ANOVA adopted. Finally, the amplitude of the moving average must be specified.

2.8. A time-series analysis requires the verification of the absence/presence of previous trends. Therefore, I suggest adding this essential control.

2.9. *“Pipeline vandalism takes place in remote locations on isolated, rural roads and footpaths; not readily accessible during adverse weather conditions.”* Since this sentence justifies a fundamental assumption, I suggest motivating it with a source.

Minor comments:

m1) Section: Method. *“The onset of COVID-19 in December 2019 and the declaration of COVID-19, on 30th January 2020, as a Public Health Emergency of International Concern by WHO (World Health Organization), and the upgrade to a pandemic by the 11th of March 2020.”* This sentence needs a reference. I can suggest this one [here](#).

m2) Section: Method. *“During the lockdown, no activists, radicals, and militants made any political statement; [...]”* It would be appropriate to justify this sentence with a source.

References

1. Amrhein V, Korner-Nievergelt F, Roth T: The earth is flat ($p > 0.05$): significance thresholds and the crisis of unreplicable research. *PeerJ*. 2017; **5**: e3544 [PubMed Abstract](#) | [Publisher Full Text](#)
2. Greenland S, Senn SJ, Rothman KJ, Carlin JB, et al.: Statistical tests, P values, confidence intervals, and power: a guide to misinterpretations. *Eur J Epidemiol*. **31** (4): 337-50 [PubMed Abstract](#) | [Publisher Full Text](#)
3. Schober P, Boer C, Schwarte LA: Correlation Coefficients: Appropriate Use and Interpretation. *Anesth Analg*. **126** (5): 1763-1768 [PubMed Abstract](#) | [Publisher Full Text](#)

Is the rationale for creating the dataset(s) clearly described?

Partly

Are the protocols appropriate and is the work technically sound?

Partly

Are sufficient details of methods and materials provided to allow replication by others?

No

Are the datasets clearly presented in a useable and accessible format?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Infodemiology, Infoveillance, Public Health, Statistics

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Author Response 24 Aug 2021

N Onwuachi-Iheagwara, Delta state university, Oleh, Nigeria

1) Section: Introduction. This section needs some additions to represent a complete background and contextualize the paper in the current scenario. Specifically, I suggest briefly discussing: 1.1. The incidence of pipeline vandalism in Nigeria and the related problems and damage (providing appropriate references)

- **Response:** Oil spillage is associated with oil pipeline destruction. The destruction of pipelines leads to several environmental problems; this includes fresh and seawater pollution, air pollution, chemical pollution, soil and land pollution [1]. This also makes most agricultural practice unsustainable with an associated decline in fish farming in populated waters, biodiversity depletion [3], loss of habitat and loss of ecological and security systems [2,3,4].

References:

1. Mmeje, David Uchechukwu, Bello Ayuba, U.D. Mohammed. Investigation of Pipeline Vandalism and Its Implications on Business Activities in Nigeria. Journal of Resources Development and Management, 2017 Vol.38, pp.69-81. ISSN 2422-8397 www.iiste.org
2. Sanusi Aishatu ,Onovo Josiah Chukwudi and Isa Hauwa'u . The Environmental Impact of Pipeline Vandalism – A Challenge to Biodiversity in Port Harcourt, Area of Rivers State, Nigeria. Int'l Journal of Advances in Chemical Engg., & Biological Sciences (IJACEBS) Vol. 3, Issue 1 (2016) ISSN 2349-1507 EISSN 2349-1515
3. Nwagboso, C.I. Security Challenges and Economy of the Nigerian State (2007 – 2011), American International Journal of Contemporary Research, 2012 Vol. 2 No. 6, 244-.258.
4. E. Ugwuanyi, "Steaming Vandalism Theft in Downstream Sector" in A.C. Okoli and S. Orinya, "Oil Pipeline Vandalism and Nigeria's National Security" (2013) Global Journal of Human Social Science

1.2. The usefulness of this study (i.e., what kind of information can this type of analysis return regarding pipeline vandalism? Why is it relevant to evaluate the impact of anti-pandemic restrictions on the phenomenon?

- **Response:** Despite the 21 years to life imprisonment for pipeline vandalism [1; Section 2 of the Petroleum Production and Distribution (Anti-Sabotage) Act Cap]; statistics have shown three main aspects of the vandalism; that must be addressed if any meaningful sustainable gain against pipeline vandalism can be addressed. One, Nigeria is losing well over 300,000 barrels per day (BPD) as a result of crude oil pipeline vandalism; [2]. Two, this translates into billions of dollars in losses [3, 4].

Where is this money? Which “class” of Nigerians are involved in this act? Also, pipeline vandalism occurs at remote locations because of the nature of the criminality [5]. In the global fight against the COVID-19, several of our liberties were suspended. This includes the freedom of movement and association. The pandemics, therefore, offer a unique opportunity to study the effect of movement restriction on pipeline vandalism. It is logical to assume a relationship between access to pipelines and physical vandalism (which involves the destruction of pipes materially). This type of destruction is not remote; it implies access. Access to the pipeline and the opportunity; are two aspects of the equation that were removed during the lockdown.

“Access” involves proximity to the pipeline during which time these structures are destroyed or compromised to gain the fluid within. Legally, at this point, the miscreant is termed a vandal. “Opportunity”, on the other hand, entails a longer time duration to enable the fluid to be scooped/removed and carted away by the (Vandals, now termed) thieves. Verification of this model, during “peacetime” is somewhat limited in a democracy. The constitution and economic considerations would not permit. The pipeline passes through a large expanse of land and to effectively lock down the route and passes would be practically impossible. However, during the pandemic, many of these considerations (economically, politically, and constitutionally) were removed, therefore the condition (for vandalism) theoretically diminished. In this light, the pandemic and consequent lockdown could be seen as an experiment. Therefore, the study would reveal the roles “opportunity” and “access to pipeline” play in vandalism. The Researchers could test if a relationship exists between observed variables and their underlying latent constructs.

To accomplish this, the researchers use empirical research, to postulate the relationship pattern and test it statistically. Why is it relevant? This paper examines the nexus between oil pipeline vandalism and public accessibility in Nigeria.

Given the adverse impact of pipeline vandalism as exemplified in loss of life, economic losses, environmental degradation, and pipeline explosions, the paper submits that an evaluation of the impact of anti-pandemic restrictions on the phenomenon is very relevant as pipeline vandalism poses a danger for economic wellbeing and national security.

References:

1. Edward Ohwofasa Okumagba .Oil and Gas Pipeline "Vandalism" in Nigeria: Analysing Alternative Options beyond the Traditional Legal Approach. International Energy Law Review. 2019 issue 7 p183-190. <https://www.researchgate.net/publication/342184010>
2. Okoli, A.C. The political ecology of the Niger Delta crisis and the prospects of lasting peace in the post amnesty period "*Global Journal of Human Social Science*, 2013, 13 (3:1.0), pp.38-46.
3. Michael Eboh 2021. “Cost of pipeline vandalization, oil theft hit N159bn in 1 year”. Vanguard. August 1, 2021. <https://www.vanguardngr.com/2020/10/cost-of-pipeline-vandalisation-oil-theft-hit-n159bn-in-1-year/>
4. O. O Udofia; O. F Joel. Pipeline Vandalism in Nigeria: Recommended Best Practice of

Checking the Menace. Paper presented at the Nigeria Annual International Conference and Exhibition, Lagos, Nigeria, August 2012. Paper Number: SPE-162980-MS, <https://doi.org/10.2118/162980-MS>, Published: August 06, 2012

5. Ahmed Tukur Umar & Moh'd Shahwahid Hajj Othman | Miao Wang (Reviewing Editor) (2017) Causes and consequences of crude oil pipeline vandalism in the Niger Delta region of Nigeria: A confirmatory factor analysis approach, Cogent Economics & Finance, 5:1, DOI: [10.1080/23322039.2017.1353199](https://doi.org/10.1080/23322039.2017.1353199)

1.3. *The significance of the paper for future research (i.e., how can this data note help government authorities deal with pipeline vandalism?)*

- **Response:** The government would be better informed and thus, can make better decisions to checkmate this vice.

Section: Methods 2.1. "These monthly reports are available for free download by the public from the NNPC website link (NNPC; <https://www.nnpcgroup.com>)" To facilitate reproducibility, I kindly ask the authors to provide a more precise URL or path description to derive this dataset. Thank you.

- **Response:** Under the land use decree, the oil wealth of the country (Nigeria) resides with the federal government. Most aspect is controlled by the Nigeria National Petroleum Cooperation (NNPC) or its subsidiaries. The NNPC publishes the "NNPC Monthly Financial Operations Report" which can be accessed by clicking "NNPC Business" and selecting "Business Information", then "Monthly Performance Data" on their website (<https://www.nnpcgroup.com>) or through (<https://www.nnpcgroup.com/NNPC-Business/Business-Information/Pages/Monthly-Performance-Data.aspx>)

2.2. *"The data were grouped into four groups, namely: [...]" I strongly suggest motivating those subdivisions in detail. In particular, based on what criteria and purpose were these groups formed?*

- **Response:** The data used were from January 2015 to January 2021. The names of each group are self-explanatory; namely: Historical data, Prior-covid-19, Covid-19 lockdown, And post-COVID- 19 lockdown. The data were grouped based on dates.

"Historic data" span from January 2015 to July 2019, these data represent pipeline vandalism data completely without COVID-19 influences. These data were collected before the outbreak, thus as there was no "knowledge" of COVID-19 during the time represented by this group, it could be assumed that COVID-19 did not influence the data collected on pipeline vandalism during this time. These data can therefore be used as a "baseline"; such as "norm". Groups 2-4 were arbitrarily set within a duration of 6-months. Pipeline vandalism during the time frame represented by groups 2-4 could be imparted by COVID-19: These groups can therefore be compared with "historical data" of the same time in the past from the historical data group, (group1) to determine if COVID-19 had in any way influenced the outcome (the number of pipeline vandalism during the stated time). To minimize/ remove seasonal variation due to the weather (wet and dry season) data were compared only with data from the corresponding seasonal frame. This is logic, data of pipeline vandalism in the summer should be compared against summer data; winter against winter in the colder zones; similarly, data of pipeline vandalism in the rainy season against data of pipeline vandalism in another rainy season in the tropic. Group 1, January 2015 to July 2019, represents a "norm". However, on closer inspection of figure1, an alteration

would be observed about June 2016, this would imply an event occurred which altered the normal sequence. For this reason, literature and newspapers were consulted to determine which event occurred about that time that led to such a drastic change in the norm. The implementation of a different security protocol was found to have occurred in May 2016. Thus, the historical data were further sub-grouped into sub-groups A, B, C, and D, representing 1-year before deployment, the year of deployment, 1-year after deployment, and 2-years after deployment, respectively. For an in-depth explanation, kindly view the Dataverse, Data for Effects of COVID-19 on pipeline vandalism in Nigeria, West Africa, (<https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/8X5KKB>) published in Dataverse for COVID-19, social distancing, and pipeline vandalism in Nigeria (<https://dataverse.harvard.edu/dataverse/Nneka>).

2.3. *"May 2016, incorporation and deployment of sophisticated weapons, use of satellite images and geographical information system (GIS) into the security apparatus to ensure vandalism is contained, the setting up of a pipeline security force to stamp out the menace, and the formation of the Trans-National Organized Crime (TNOC) with regional allies to fight against the proliferation of Small Arms and Light Weapons. 4". Reference 4 refers to a web page called "Oil and Gas 360." Therefore, I kindly ask if it is possible to provide a more specific URL or refer to an academic source.*

- **Response:** It is not an academic paper; it is an EVENT reported in the news; hence a newspaper is an appropriate source for this information. The reference is: Levinus Nwabughigu, C. (2016, May 28). Buhari's milestones in one year – Presidency. Vanguard: <https://www.vanguardngr.com/2016/05/buharis-milestones-in-one-year-presidency/>

2.4. *"In Nigeria, the pre-lockdown commenced from 28th February – 29th March 2020, and was 31 days in duration. The lockdown, in total 35 days; was from 30th March to 3rd May 2020, and easing up of 73 days, 5th May – 15th July 2020." This information needs a reference.*

- **Response:** Ibrahim RL, Ajide KB, Olatunde Julius O. Easing of lockdown measures in Nigeria: Implications for the healthcare system. *Health Policy Technol.* 2020;9(4):399-404. doi:10.1016/j.hlpt.2020.09.004 and Dan-Nwafor, Chioma et al. "Nigeria's public health response to the COVID-19 pandemic: January to May 2020." *Journal of global health* vol. 10,2 (2020): 020399. doi:10.7189/jogh.10.020399

2.5. *"The May 2016 event (from a cursory glance of Figure 1) had a great impact on cases of pipeline vandalism." Figure 1 shows that the decreasing trend has occurred since July 2016. Therefore, it is necessary to argue the causal nature of the association made and discuss the presence of a time-series lag.*

- **Response:** A "lag" is a fixed amount of time. A lag plot is a special case of x, y plot; wherein a set of observations is plotted lagged against a second set of observations. It is our view that adequate information on the number of cases of pipeline vandalism by time (month/year) is conveyed by figure 1. The possible causal nature/ the association of other events with cases of vandalism are shown in the graph. Yes, it can be argued that an association exists between the decreasing trend after the deployment and the deployment.

2.6. *"In all statistical analysis in this project, an alpha = 0.05 as the significance threshold was set, and a null and an alternative hypothesis were established. This means that the null hypothesis would be rejected if the p-value is less than or equal to 0.05 and the alternative hypothesis would be accepted." Using a simple threshold for significance analysis is misleading (Amrhein et al.*

(20171), Greenland et al. (20162)). *P-values should be used - at best - as a graded measure of the strength of evidence against the null hypothesis. Therefore it is necessary to report the P-values in full (if this is not possible, it is advisable to provide an additional file). Furthermore, P-values are unsuitable for measuring the intensity of a phenomenon (e.g., very weak but statistically significant phenomena can occur (Schober et al. (20183))). Therefore I suggest introducing quantifiers into the analysis (e.g., percentage differences).*

- **Response:** In recent times, some scholars have **challenged the use of** a threshold to declare the statistical significance of the p-value, [1]. Two main arguments are, one; research data contain more meaning than is summarized in a P-value and its statistical significance, and two; the concepts are frequently misunderstood and consequently inappropriately interpreted. The abolishment of p-values has been echoed in such an article as "Should statistical significance be retired?" [DOI: 10.1007/s00393-020-00835-x, download at <https://pubmed.ncbi.nlm.nih.gov/32621162/>]. We, however, do not wish to be drawn into *that* argument. In line with best practice for transparency in data analysis, our research hypotheses were clearly articulated; they are; namely: Null hypothesis: There is no significant difference between the mean case of pipeline vandalism incidences prior, during, and post COVID-19 lockdown. Alternative hypothesis: There is a significant difference between the mean cases of pipeline vandalism incidences prior, during, and post COVID-19. Traditionally, researchers examine such differences between groups using t-test, Anova [2,3,4]. We used ANOVA; however, in the second version, percentage differences shall be added as quantifiers into the analysis.

References:

1. Andrade, Chittaranjan. "The P-Value and Statistical Significance: Misunderstandings, Explanations, Challenges, and Alternatives." Indian journal of psychological medicine vol. 41,3 (2019): 210-215. doi:10.4103/IJPSYM.IJPSYM_193_19. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6532382/>
2. http://mason.gmu.edu/~afinn/html/teaching/courses/f03_comm250/fbk_chapters/13.pdf
3. <https://www.sciencedirect.com/science/article/pii/S1877042813029686/pdf?md5=2ee7f2597100s2.0-S1877042813029686-main.pdf>
4. <https://www.arcjournals.org/pdfs/ijsimr/v3-i12/10.pdf>

2.7. *"The sub-grouped data were also subjected to an ANOVA, and a time series analysis (after the data were smoothened by moving average)." ANOVA analysis requires the verification of a certain number of assumptions, as explained here. Therefore, how the latter has been verified must be described in detail. Moreover, it is necessary to specify the type of ANOVA adopted. Finally, the amplitude of the moving average must be specified.*

- **Response:** The assumptions in ANOVA are concerned with the population distribution. These three assumptions are:
 1. Homoscedasticity of the dependent variable (equality of variances among group
 2. Dependent variable is normally distributed within each group
 3. Each observation in the sample is independent of all others

The type of ANOVA: In this investigation, one-way ANOVA was used. A one-way ANOVA is a statistical test used to determine whether or not there is a significant difference between

the means of three or more independent groups.

The assumptions in the one-way ANOVA are:

1. Normality: that each sample is taken from a normally distributed population.
2. Sample independence: that each sample has been drawn independently of the other samples.
3. Variance Equality: that the variance of data in the different groups should be the same.

The verification of the assumptions used in the ANOVA analysis. Normality can check visually or, by a histogram. Variance can be checked with a boxplot. For the third assumption, there is no formal test to verify that the observations in each group are independent. Finally, the amplitude of the moving average must be specified. The amplitude of the moving average shall be elaborated in the second version of the article

2.8. A time-series analysis requires the verification of the absence/presence of previous trends. Therefore, I suggest adding this essential control.

- **Response:** This shall be added in the second version of our paper. Thank you for your observation.

2.9. "Pipeline vandalism takes place in remote locations on isolated, rural roads and footpaths; not readily accessible during adverse weather conditions." Since this sentence justifies a fundamental assumption, I suggest motivating it with a source.

- **Response:** Olu-Adeyemi (2020). The Political Ecology of Oil Pipeline Vandalism in Nigeria Lanre. International Journal of Research and Innovation in Social Science (IJRISS) | Volume IV, Issue V, May 2020 | ISSN 2454-6186 and Okoli, Al Chukwuma (2019). Oil Pipeline vandalism In the Niger Delta. Accord: Conflict Trendsop. Cit: <https://www.accord.org.za/conflict-trends/oil-pipeline-vandalism-in-the-niger-delta/>

Minor comments:

m1) Section: Method. "The onset of COVID-19 in December 2019 and the declaration of COVID-19, on 30th January 2020, as a Public Health Emergency of International Concern by WHO (World Health Organization), and the upgrade to a pandemic by the 11th of March 2020." This sentence needs a reference. I can suggest this one here. Sohrabi C, Alsafi Z, O'Neill N, et al. World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19) [published correction appears in Int J Surg. 2020 May;77:217]. Int J Surg. 2020;76:71-76. doi:10.1016/j.ijsu.2020.02.034 and Cucinotta D, Vanelli M. WHO Declares COVID-19 a Pandemic. Acta Biomed. 2020 Mar 19;91(1):157-160. doi: 10.23750/abm.v91i1.9397. PMID: 32191675; PMCID: PMC7569573.

- **Response:** Thank you, we will include it.

m2) Section: Method. "During the lockdown, no activists, radicals, and militants made any political statement; [...]" It would be appropriate to justify this sentence with a source.

- **Response:** As noted in response to your question in 2.3 above. Everything is not an academic paper. When activists, militants strike a pipeline installation it is reported in the News. This implies an absence of reports in the absence of a strike.

Overall, thank you for your observations.

Competing Interests: There are no competing interests to declare.

The benefits of publishing with F1000Research:

- Your article is published within days, with no editorial bias
- You can publish traditional articles, null/negative results, case reports, data notes and more
- The peer review process is transparent and collaborative
- Your article is indexed in PubMed after passing peer review
- Dedicated customer support at every stage

For pre-submission enquiries, contact research@f1000.com

F1000Research