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Generalised anxiety disorder in adolescents in Ghana: Examination of the psychometric properties of the Generalised Anxiety Disorder-7 scale

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The Generalised Anxiety Disorder-7 (GAD-7) is a self-report scale used to assess general anxiety symptoms. Although the GAD-7 has been found to be a valid scale among adults, studies examining its psychometric properties among adolescents in high-income countries are notably limited and particularly non-existent in low- and middle-income countries. The current study addresses this lacuna by investigating the factorial validity, construct validity, internal consistency and discriminant accuracy of the GAD-7. Data were collected from 553 adolescents (boys = 231; average age = 16.85) recruited from a senior high school in Ghana, a sub-Saharan African country, using cross-sectional self-report methodology. The result supports a unidimensional structure of the GAD-7 that was invariant across gender. The GAD-7 correlates significantly with measures of anxiety, suicidal tendencies and mental well-being, suggesting construct validity. The internal consistency of the GAD-7, based on the mean inter-item correlation value of 0.24 and Cronbach's α = 0.69, is adequate. The GAD-7 similarly discriminated between individuals at high risk of suicidal tendencies and depression from those with low or no risk, with area under curve values of 0.71 and 0.70, respectively. The GAD-7 is a reliable and valid measure to screen for generalised anxiety disorder among adolescents in Ghana.

Keywords: Generalised Anxiety Disorder; GAD-7; Validation; Psychometric Properties; Adolescents; Africa.

Introduction

Adolescents are highly prone to developing a range of mental health problems, including generalised anxiety disorder (GAD) which is characterised by excessive, uncontrollable, irrational anxiety and worry (APA, 2013; Wittchen, Zhao, Kessler, & Eaton, 1994). The lifetime prevalence rates of GAD range from 1.5% to 3% in adolescents (Merikangas et al., 2010) and from 7.3% to 13% in clinical samples (Caballero, Bobes, Vilardaga, & Rejas, 2009; Chocrón Bentata, Vilalta Franch, Legazpi Rodríguez, Auquer, & Franch, 1995). Generalised anxiety disorder has been associated with poor health-related quality of life and functionality (Bereza, Machado, & Einarson, 2009), general impairment (Wittchen, 2002) and comorbidity with depression and social phobia (Tiirikainen, Haravuori, Ranta, Kaltiala-Heino, & Marttunen, 2019). Unsurprisingly, GAD has been reported to contribute to 17% of the disability-adjusted life years lost among 15–19-year-old adolescents (Mokdad et al., 2016).

The foregoing notwithstanding, many adolescents with GAD, particularly in low- and middle-income countries (LMICs), are often undetected and untreated (Kroenke, Spitzer, Williams, Monahan, & Löwe, 2007; Lieb, Becker, & Altamura, 2005) mainly because of the lack of reliable and valid screening and assessment measures (Owen, Baig, Abbo, & Baheretibeb, 2016; Tran et al., 2018). This development has contributed greatly to the widening of mental health treatment gap (Owen et al., 2016), as well as lack of data on the burden of mental health problems in LMIC (Cortina, Sodha, Fazel, & Ramchandani, 2012; Tran et al., 2018).

Valid, reliable and easy-to-administer screening tests could help detect individuals at risk of GAD for early intervention, as well as for large-scale epidemiological studies on the prevalence, risk factors and protective factors of GAD. The Generalised Anxiety Disorder-7 (GAD-7) scale is a 7-item easy to administer tool developed to screen for probable cases of GAD based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria (Spitzer, Kroenke, Williams, & Löwe, 2006). A recent systematic and meta-analytic review has revealed that the GAD-7 has acceptable psychometric properties in adult samples (Plummer, Manea,

Trepel, & McMillan, 2016). The bulk of the studies suggest that the GAD-7 has a unidimensional or one-factor structure (Ito, Takebayashi, Muramatsu, & Horikoshi 2018; Löwe et al., 2008; Sawaya, Atoui, Hamadeh, Zeinoun, & Nahas, 2016; Sousa et al., 2015; Tiirikainen et al., 2019), although others have reported a two-factor structure (Beard & Björgvinsson, 2014; Ito et al., 2018). Additionally, the GAD-7 has demonstrated sound diagnostic properties with a sensitivity of 89% and specificity of 82% at a cut-off of 10 points in clinical populations (Kroenke et al., 2007; Spitzer et al., 2006). As one of the widely used screening measures for GAD, the GAD-7 has been translated into different languages, including Portuguese (Sousa et al., 2015), Dutch (Donker, Van Straten, Marks, & Cuijpers, 2011), Finnish (Kujanpää et al., 2014), Spanish (García-Campayo et al., 2010), German (Löwe et al., 2008) and Malay (Sidik, Arroll, & Goodyear-Smith, 2012).

However, there are questions regarding the utility of the GAD-7 when administered on adolescent samples, given that studies investigating the psychometric properties of the GAD-7 among adolescents are emerging. To the best of our knowledge, only Tiirikainen et al. (2019) investigate the psychometric properties of the GAD-7 in adolescents in Finland. The authors reported that the GAD-7 is a valid and reliable measure with a unidimensional factor structure similar to those reported in adult populations. No study has investigated the psychometric properties of the GAD-7 in adolescents living in sub-Saharan African (SSA) countries that differ from their counterparts in high-income on several factors. These include differences in socio-economic status and prevalence of risk factors of mental health problems such as war, trauma, child abuse and neglect, being orphaned, and food insecurity (Cortina et al., 2012; Reiss, 2013).

Cultural context significantly shapes behaviour, including how people feel, think and interact socially, as well as what constitute distress and the threshold for distress (Moleiro, 2018). It has long been observed that Western, individualistic cultures tend to shape the behaviours of individuals somewhat differently from non-Western, collectivist cultures (Huntington, 1996; Nqweni, Pinderhughes, & Hurley, 2010; Padmanabhanunni, 2019). In this context, what constitutes anxiety and the threshold for detecting and endorsing the same may differ between individualistic and collectivists cultures. More so is the observation that the acquisition and expression of behaviours tend to differ somewhat between men and women located in one cultural setting. Relating specifically to Ghana, boys are, for instance, socialised to develop hard and resilient personalities not only to be able to withstand adverse conditions in life but also to be able to provide for the needs of their parents in old age. In contrast, girls are more likely to be socialised within a vulnerability framework and also are encouraged to seek protection, mostly from boys (Adjorlolo, Adu-Poku, Andoh-Arthur, Botchway, & Mlyakado, 2017b). The somewhat different socialisation processes for boys and girls could influence the extent to which they acquire, acknowledge and express psychopathological behaviours, suggesting that assessment measures for anxiety could perform differently across the genders.

Because the psychometric properties of Western-based measures could be altered substantially when administered in SSA (Adjorlolo, Abdul-Nasiru, Chan, & Bentum Jr, 2017a; Adjorlolo & Watt, 2017), examining, for instance, the underlying factor structure of the GAD-7 will help to determine whether this measure taps into GAD in SSA (i.e. factorial validity). It follows that the call for more studies into the psychometric properties of the GAD-7 (Tiirikainen et al., 2019) should also take into consideration its cross-cultural validation (Doi, Ito, Takebayashi, Muramatsu, & Horikoshi, 2018).

Consequently, the current study was designed to investigate the psychometric properties of the GAD among adolescents in Ghana to contribute to the emerging (cross-cultural) literature regarding the application of the GAD-7 in adolescents. In this regard, the study first and foremost examined the factorial validity of the GAD-7 and further determined whether the factorial validity is the same for boys and girls (i.e. invariant across gender). Gender invariance analysis examines the extent of similarity on the endorsement of the GAD-7 items for boys and girls, thereby helping to ensure that the GAD-7 scores are not biased (i.e. under or overestimated) for one group (Steinmetz, Schmidt, Tina-Booh, Wieczorek, & Schwartz, 2009). Secondly, the study investigated the internal consistency and the construct validity of the GAD-7. Lastly, given that anxiety is often comorbid with depression (Brady & Kendall, 1992) and correlates highly with suicidal tendencies (Balázs et al., 2013), the ability of the GAD-7 to discriminate between participants designated as high risk and low or no risk for depression and suicidal tendencies was examined.

Method
Sample
The total student population at the time of data collection was 650. Of the 600 questionnaires administered, 555 were returned, representing a response rate of 92.5%. Two substantially uncompleted questionnaires were subsequently excluded.

Ghana's educational system operates on a 6-3-3-4 system (i.e. primary school – 6 years, junior high school – 3 years, senior high school – 3 years and university bachelor's degree – 4 years). The school was selected using a multi-stage sampling technique, involving a random selection of Eastern region out of the 10 regions in Ghana. This was followed by a random selection of a district in the region and one senior high school in the district. Information relating to the various schools in the selected district was obtained from the Ghana Education Service. English is the official language of instruction at the various levels of education (Adjorlolo, 2016). More than half of the

participants were girls (*n* = 322, 58.1%) with an average age of 16.85 (standard deviation [s.d.] = 1.32).

Measures

A self-report methodology using a cross-sectional survey design was employed to gather data from senior high school students recruited from a school in the Eastern region of Ghana. A questionnaire consisting of a demographics section, the GAD-7, PHQ, WHO-5 and SBQ-R was used.

Generalised Anxiety Disorder-7 items are rated on a 4-point Likert scale, ranging from 0 (not at all) to 3 (nearly always). The seven items are summed to generate a total score that ranges from 0 to 20 in the present study. Higher scores indicate more severe symptoms of GAD.

Patient Health Questionnaire-9 (PHQ; Kroenke, Spitzer, & Williams, 2001) was administered to measure depressive symptoms in the participants. The PHQ-9 items are rated on a four-point scale ranging from 'not at all' (0) to 'nearly every day' (3). Higher scores, obtained by summing the participants' responses, indicate more depressive symptoms. The Cronbach's alpha recorded in the present sample was 0.71.

World Health Organization Well-Being Index (WHO-5; Topp, Østergaard, Søndergaard, & Bech, 2015) is a five-item scale used to index subjective, positive well-being. The items are scored from 5 (all of the time) to 0 (none of the time), with a total score ranging from 0 (absence of well-being) to 25 (maximal well-being). A Cronbach's alpha of 0.70 was observed for the present sample.

Suicidal Behaviour Questionnaire-Revised (SBQ-R; Osman et al., 2001) is a four-item scale administered to screen for suicidal tendencies. The items are rated on Likert scales as follows: item 1 = 1–4, item 2 = 1–5, item 3 = 1–3 and item 4 = 0–6. The SBQ-R total score ranges from 3 to 18, with higher scores reflecting greater risk for suicidal tendencies. Prior studies have found positive and significant correlations between suicidal tendencies and anxiety or GAD (Balázs et al., 2013; Nepon, Belik, Bolton, & Sareen, 2010). The Cronbach's alpha reported in the present study was 0.78.

Procedure

Data were collected from the students in their respective classes. In each class, the research team briefed the participants on the purpose of the study and their responsibilities as participants. They were encouraged to ask questions to allay any fear and anxiety pertaining to participating in the study. Ethical issues, particularly those relating to confidentiality, anonymity and withdrawal from the study without being penalised, were communicated to the participants and ensured. To maintain anonymity, for instance, the questionnaires were devoid of identifying information of the participants such as name and student numbers. The participants were also informed that their responses will be treated strictly confidentially, and that

they can withdraw from the study anytime without being penalised, or the research team can terminate their participation without their explicit consent. Those expressing interest and willing to participate in the study were handed a pack of questionnaires described previously. The questionnaires were handed over to the research team in each class upon competition. Data were collected from the second- and third-year students because the first-year students were yet to commence school at the time of data collection.

Data analysis

Missing data analysis revealed that less than 5% of cases have data points missing on the SBQ-R (2.4% – 3.1%), PHQ (2% – 3.3%), GAD-7 (1.3% – 2.7%) and WHO-5 (1.3% – 2.4%). Further analyses revealed that data were missing completely at random (Little's chi-square > 0.05). Consequently, the missing data point was imputed using the expectation-maximisation algorithm (Adjorlolo & Watt, 2017). Confirmatory factor analysis, using the maximum likelihood method, was used to test for the factorial validity of the GAD-7. A multi-group CFA was conducted to determine the invariance of the associations between the observed items and the latent factor. This was performed sequentially in the following ways (see Adjorlolo & Watt, 2017; Byrne, 2010; Steinmetz et al., 2009). Firstly, separate models were estimated for boys and girls, called the baseline model. Secondly, an unconstrained model was established whereby the fixed and free parameters were estimated simultaneously for the groups (i.e. configural invariance). Thirdly, the factor loadings were constrained across the groups to establish metric invariance. Next, the factor variance was constrained, in addition to the factor loadings to investigate invariance of factor variance. Lastly, the factor loadings, factor variance and error variances were constrained to be equal across the groups to determine the invariance of error variances. Constraining error variances is important for testing the equality of reliability of the GAD-7 across the groups (Byrne, 1988).

Evidence of gender invariance was evaluated using the difference in comparative fit index (CFI; ΔCFI) and chi-square (χ^2; $\Delta\chi^2$). A non-significant $\Delta\chi^2$ and ΔCFI $\geq$ -0.01 between the restrictive and less restrictive or unconstrained models indicate the attainment of gender invariance. In case of discordance between the $\Delta\chi^2$ and ΔCFI, the estimates provided by the latter were deemed reliable. This is because, unlike the $\Delta\chi^2$, the ΔCFI is independent of the sample size and model complexity, and is also uncorrelated with the overall fit measures (Cheung & Rensvold, 2002). Model fit was determined using χ^2 and the following commonly used fit indicators: CFI, Tucker–Lewis index (TLI), adjusted goodness of fit index (AGFI) and a non-centrality-based index, the root mean square error of approximation (RMSEA). Comparative fit index and TLI values close to 0.95, or greater, and RMSEA value close to 0.06 or below indicate good model fit (Hu & Bentler, 1999). The CFA and multi-group CFA were performed using Analysis of Moment Structures (AMOS) version 21.

Zero-order correlations with measures of anxiety, mental well-being and suicidal tendencies were performed to examine construct validity of GAD-7, whereas internal consistency was investigated using Cronbach's alpha (α) and mean inter-item correlation (MIC; Clark & Watson, 1995). The discriminant validity of the GAD-7 was determined using the receiver operating curve (ROC), with the area under the curve (AUC) of the ROC indicating the overall discriminant accuracy. The AUC value ranges between 0.5 (no discriminative power) and 1.0 (maximum discriminative power). The zero-order correlations, internal consistency and ROC analyses were conducted using IBM Corp. SPSS version 23.

Ethical considerations

The Ethics Committee for Humanities of the University of Ghana granted ethical approval for the study (Ethical clearance number: ECH 165/17-18). The school management granted institutional permission for the study.

Results

Prevalence of generalised anxiety disorder, depression and suicidal tendencies

Participants endorsing the highest response options on the items of the various measures were designated as high risk. Using this criterion, 4.2% ($n = 23$), 17% ($n = 95$) and 18% ($n = 102$) of the participants were designated as at high risk for GAD, suicidal tendencies and depression, respectively.

Factorial validity and gender invariance of Generalised Anxiety Disorder-7

The results of the factorial validity and gender invariance analyses of the GAD-7 are summarised in Table 1. The GAD-7

evidenced a unidimensional factor structure, providing a good fit to the data in the full sample (AGFI = 0.98; TLI = 0.97; CFI = 0.98; RMSEA = 0.03), boys subsample (AGFI = 0.96; TLI = 0.97; CFI = 0.98; RMSEA = 0.04) and girls subsample (AGFI = 0.96; TLI = 0.96; CFI = 0.98; RMSEA = 0.03). Measurement invariance analyses indicate that configural invariance (GFI = 0.97; TLI = 0.96; CFI = 0.97; RMSEA = 0.03), metric invariance (ΔCFI = -0.002), invariance of factor variance (ΔCFI = 0.000) and invariance of error variances (ΔCFI = 0.001) have been attained. As shown in Table 2, the GAD-7 items loaded satisfactorily and significantly onto the unidimensional factor structure. A two-factor model was also tested in accordance with previous studies (Beard & Björgvinsson, 2014; Ito et al., 2018). It was observed that the model for the full sample did not provide a good model fit to the data (i.e. AGFI = 0.88; TLI = 0.74; CFI = 0.67; RMSEA = 0.09). Further analyses reveal that the girls (AGFI = 0.75; TLI = 0.92; CFI = 0.64; RMSEA = 0.11) and boys (AGFI = 0.89; TLI = 0.94; CFI = 0.76; RMSEA = 0.09) subsamples did not yield good model fits. Inspection of the modification indices and coefficient suggests that no alteration of the models will cause improvement to the model. Given that these initial model assessments are critical to measurement invariance analysis, a decision was reached not to investigate the models further by constraining the model parameters. It was therefore concluded a unidimensional model fit the data for Ghanaian adolescents' sample.

Construct validity and internal consistency of Generalised Anxiety Disorder-7

The GAD-7 correlated significantly and positively with measures of depression ($r = 0.67$, $p < 0.001$; $r = 0.68$, $p < 0.001$; $r = 0.67$, $p < 0.001$), suicidal behaviour ($r = 0.40$, $p < 0.001$; $r = 0.44$, $p < 0.001$; $r = 0.37$, $p < 0.001$) and negatively with

TABLE 1: Fit statistics for the Generalised Anxiety Disorder-7 scale in adolescents.

Model/fit indices	χ^2†	df	χ^2/df	AGFI	TLI	CFI	RMSEA	$\Delta\chi^2$	df	ΔCFI
Full sample	22.79	14	1.63	0.98	0.97	0.98	0.03	-	-	-
Boys subsample	18.52	14	1.32	0.96	0.97	0.98	0.04	-	-	-
Girls subsample	19.13	14	1.37	0.96	0.96	0.98	0.03	-	-	-
Gender invariance								-		
Unconstrained	37.65	28	1.35	0.96	0.97	0.98	0.03	-	-	-
Constrained 1	44.70	34	1.32	0.96	0.97	0.98	0.02	7.05†	6	-0.002
Constrained 2	45.51	35	1.30	0.96	0.97	0.98	0.02	0.81†	1	0.000
Constrained 3	52.33	42	1.25	0.97	0.98	0.98	0.02	6.82†	7	0.001

Unconstrained = parameters freely estimated; Constrained 1 = factor loadings constrained; Constrained 2 = Factor variance constrained; Constrained 4 = Error variances constrained.
†, not significant; df, degrees of freedom AGFI, adjusted goodness of fit index; TLI, Tucker–Lewis index; CFI, comparative fit index; RMSEA, root mean square error of approximation.

TABLE 2: Characteristics of Generalised Anxiety Disorder-7 scale items (boys = 231, girls = 322).

No.	Scale item	Full sample				Boys subsample				Girls subsample			
		M	s.d.	CIC	FL	M	s.d.	CIC	FL	M	s.d.	CIC	FL
1	Feeling nervous, anxious or on edge	0.69	0.95	0.37	0.45	0.61	0.91	0.42	0.49	0.75	0.99	0.33	0.40
2	Not being able to stop or control worrying	0.95	1.00	0.43	0.54	0.86	1.00	0.46	0.56	1.00	0.99	0.41	0.52
3	Worrying too much about different thing	1.20	1.00	0.41	0.52	1.10	1.00	0.46	0.57	1.10	1.00	0.38	0.47
4	Trouble relaxing	0.63	0.93	0.33	0.41	0.62	0.92	0.32	0.38	0.64	0.94	0.34	0.44
5	Being so restless that it is hard to sit at one place	0.75	0.97	0.31	0.37	0.87	1.00	0.40	0.48	0.67	0.92	0.26	0.32
6	Becoming easily annoyed or irritable	0.94	1.10	0.44	0.55	0.90	1.00	0.50	0.60	0.97	1.10	0.40	0.50
7	Feeling afraid as if something terrible or bad might happen	1.10	1.10	0.45	0.56	0.95	1.10	0.42	0.51	1.20	1.10	0.47	0.61

M, mean; s.d., standard deviation; CIC, corrected item-total correlation; FL, factor loadings.

mental well-being (r = -0.35, p < 0.001; r = -0.32, p < 0.001; r = -0.37, p < 0.001) in the full sample, boys and girls subsamples, respectively.

Likewise, the internal consistency of the GAD-7 for the full sample, based on the Cronbach's alpha (α), was 0.69, whereas the MIC was 0.24 for the full sample. Similar result was obtained for boys (α = 0.72; MIC= 0.26) and girls (α = 0.66; MIC = 0.22) subsamples.

Discriminant accuracy of the Generalised Anxiety Disorder-7

The GAD-7 significantly discriminated between participants designated as high and low or no risk for depression (AUC = 0.70; z = 6.77, p < 0.001; CI [0.66, 0.74]), as well as high and low or no risk of suicidal tendencies (AUC = 0.71; z = 7.70, p < 0.001; CI = [0.67, 0.75]).

Discussion

The study primarily investigated the psychometric properties of the GAD-7 among adolescents in Ghana. In keeping with the findings of earlier multi-site, adult-based studies (Ito et al., 2018; Löwe et al., 2008; Sawaya et al., 2016; Sousa et al., 2015) and a recent Finnish, adolescent-based study (Tiirikainen et al., 2019), the GAD-7 showed a unidimensional structure among Ghanaian adolescents. The factor structure of the GAD-7 is stable in the present sample, given that it was not data-driven (i.e. no change was affected to the model based on the modification indices). This observation raises the possibility that a unidimensional structure of the GAD-7 will emerge in similar or related adolescent samples from Ghana (Adjorlolo et al., 2017a).

The GAD-7 items loaded significantly onto the unidimensional factor structure, with all the factor loadings exceeding the conventional value of 0.30 (Nunnally, 1978). Likewise, the corrected item-total correlation values indicate that all the items contributed meaningfully to the GAD-7 (Barthel et al., 2015). More importantly, the unidimensional structure of the GAD-7 was invariant for boys and girls, suggesting that the same or similar relationships can be expected between the GAD and its indicators for boys and girls (Doi et al., 2018). Thus, any gender-based mean-level difference or difference in prevalence and incidence estimates could not be attributed to the biases of the GAD-7 for one group (Baas et al., 2011). The study suggests that the GAD-7 has the propensity to tap into GAD across different settings for both boys and girls. Stated alternatively, the expression of symptoms of anxiety as captured by the GAD-7 may not necessarily be influenced by the cultural background of the participants and both boys and girls are more likely to demonstrate statistically similar response patterns on the GAD-7.

Moreover, although the Cronbach's alpha of the GAD-7 was comparatively low (i.e. 0.69), the MIC values, which are largely independent of the number of the item, are all in the recommended ranges (i.e. 0.15–0.50) to be considered adequate (Clark & Watson, 1995). It is therefore posited tentatively that the GAD-7 is internally consistent for boys and girls, in keeping with the findings of previous studies (Ito et al., 2018; Löwe et al., 2008; Sawaya et al., 2016; Sousa et al., 2015; Tiirikainen et al., 2019). The GAD-7 correlated significantly with measures of depression, suicide and mental well-being, thereby confirming the construct validity of the GAD-7. Likewise, the GAD-7 discriminated between individuals at high risk of suicidal tendencies and depression from those with low or no risk, although the discriminant accuracy was moderate (Swets, 1988). All in all, the GAD-7 demonstrated sound psychometric properties and moderate discriminant accuracy among adolescents in Ghana.

Limitations of the study

Firstly, the study did not include a gold standard measure of GAD, thereby making it impossible to assess the diagnostic properties (e.g. sensitivity and specificity) of the GAD-7 for GAD, in addition to depression and suicidal tendencies. The use of self-report measures provides no mechanism to verify the accuracy of the participants' responses. Thus, inaccurate responses (underreporting or over-reporting) are possibilities. The generalisability of the study findings to adolescents with dissimilar background characteristics (e.g. those out of school) may be limited. Again, using a clinical sample would have provided an added layer of validity, and therefore it would be useful in future studies to examine adolescents diagnosed with GAD. Future studies addressing the limitations noted here will help to further illuminate the psychometric appropriateness and utility of the GAD-7 in adolescents in Ghana and other LMICs.

Conclusion

The results suggest that the GAD-7 is a reliable and valid measure to screen and identify adolescents at risk of GAD in Ghana, an SSA state. The findings have contributed to the repertoire of the cross-cultural literature on the assessment of psychopathologies or mental disorders. While the influence of cultural factors on psychopathological behaviours should not be discounted, it is equally important to acknowledge that measures developed to assess behaviours that supposedly have roots in Western, individualistic cultures could prove useful in non-Western, collectivists' cultures.

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Data availability statement

Data is available upon request from the author.

Disclaimer

The views expressed in this article are the author's own and not the official position of his institution.

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