International Journal of Public Health
EDITORIAL
published: 15 October 2021
doi: 10.3389/ijph.2021.1604483

WHO Air Quality Guidelines Need to be Adopted

*Heresh Amini**

Department of Public Health, University of Copenhagen, Copenhagen, Denmark

Keywords: air pollution, conformity, particulate matter, nitrogen dioxide, ozone

It is very well known that air pollution causes death, and a wide spectrum of health conditions, with considerable burden for the world's population [1]. There is evidence also for the association of air pollution with SARS-CoV-2 transmission, COVID-19 infection severity, and its mortality [2–4].

The World Health Organization (WHO) has launched air quality guidelines (AQG) 2021 about 15 years after 2005 AQGs for short- and long-term exposure to a range of air pollutants, such as particulate matter ($PM_{2.5}$ and PM_{10}), ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2) and carbon monoxide (CO) [5]. In brief, most 2021 AQGs are lower compared to 2005 using updated WHO methodology, and given the fact that new evidence shows health effects occur even at lower exposure levels [6–8]. The updated WHO AQGs are based on thorough systematic reviews and meta-analyses of evidence up to mid-2020 [5].

Of notable updates, the 2021 AQG compared to 2005 for annual mean exposure to $PM_{2.5}$ reduced from 10 to 5 μg/m^3, PM_{10} reduced from 20 to 15, and NO_2 reduced from 40 to 10 μg/m^3. Furthermore, there is new 2021 AQG for peak season O_3 (60 μg/m^3) and 24-hour exposure to CO (4 mg/m^3). The AQG for 24-hour exposure to SO_2 increased from 20 μg/m^3 in 2005 to 40 μg/m^3 in 2021, which is due to updated evidence and methodology for AQGs. Amongst other updates, the 2021 AQGs also provide good practice statements for certain types of PM, such as black carbon/elemental carbon, ultrafine particles, and dust- and sandstorms. It is notable that WHO AQGs further provide Interim Targets (ITs) for most pollutants for stepwise progress towards achieving the AQGs. As WHO emphasized, it is very important to note that the 2005 WHO AQGs remain valid for pollutants and those averaging times not covered in 2021 update [5].

As shown in **Figure 1**, it is evident that there is inequality in exposure to air pollution across the world with low- and middle-income countries (LMICs) experiencing higher exposure levels for most pollutants. Currently, large world populated areas do not meet the WHO AQG 2021 for annual mean exposure to $PM_{2.5}$, annual mean NO_2, and seasonal maximum O_3, and many countries are even in a position that need to consider IT1 for $PM_{2.5}$ (35 μg/m^3) as the first step to achieve, which is indeed challenging. NO_2 is considerably higher within urban areas, and ground level O_3 has high values across the Middle East and India (**Figure 1**).

The WHO AQGs 2021 have important implications for WHO member states and public health. With the launch of WHO AQGs 2021, WHO has provided the member states with a tool that need to be adopted to protect public health from air pollution as a so-called "silent killer." As stated in a joint statement by Hoffmann et al. [12], which is endorsed by more than hundred medical, public health, scientific and patient representative societies, such as European Respiratory Society (ERS) and the International Society of Environmental Epidemiology (ISEE), immediate action is needed to use these guidelines for emission reduction policy making and adopt these science-based guidelines and interim targets as national air quality standards. Clearly, healthy lungs and healthy hearts need clean air [3, 13].

Edited and reviewed by:
Nino Kuenzli,
Swiss Tropical and Public Health Institute (Swiss TPH), Switzerland

***Correspondence:**
Heresh Amini
heresh.amini@sund.ku.dk

Received: *22 September 2021*
Accepted: *01 October 2021*
Published: *15 October 2021*

Citation:
Amini H (2021) WHO Air Quality Guidelines Need to be Adopted. Int J Public Health 66:1604483. doi: 10.3389/ijph.2021.1604483

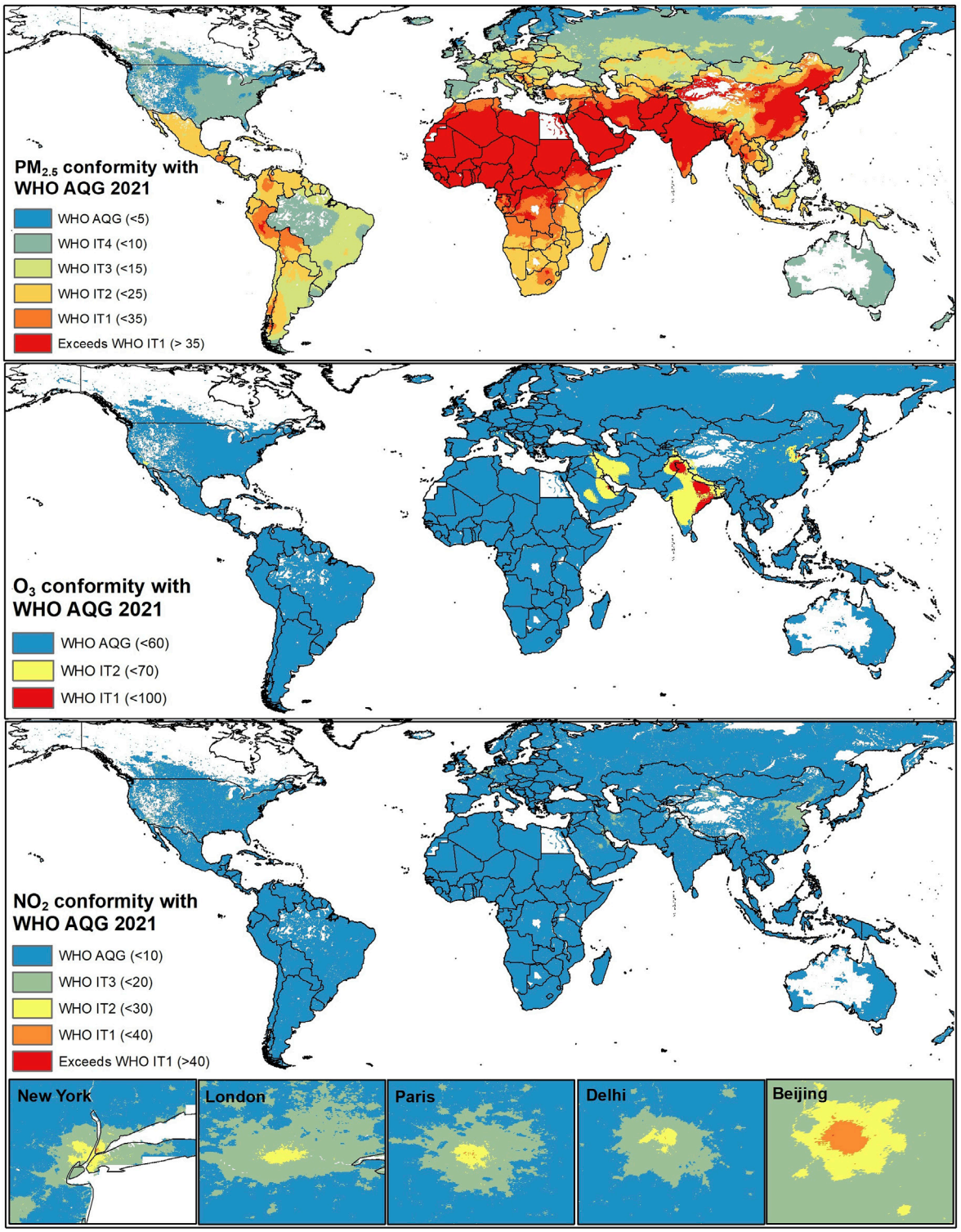

FIGURE 1 | The conformity of 2019 annual mean $PM_{2.5}$, 2019 seasonal maximum O_3, and 2011 annual mean NO_2 with the WHO Air Quality Guidelines (AQG) 2021 and interim targets (IT) across the world. Human populations do not populate the white areas within the countries. Source: $PM_{2.5}$ adapted from Shaddick et al. (2018) [9] and Global Burden of Disease (GBD) 2019 Risk Factor Collaborators [1, 9], O_3 adapted from Chang et al. (2019) and GBD 2019 Risk Factor Collaborators [1, 10], and NO_2 adapted from Larkin et al. (2017) [11].

It is not only the duty of governments to achieve these goals, but also it is a societal responsibility for all individuals to move in the right direction and reduce the unacceptable burden of air pollution (millions of lost lives, years of life disabled and lost, and related costs). The extent of the reduction is directly translated into improvement in public health. This require actions that are in line with climate action as one of the 17 Sustainable Development Goals established by the United Nations in 2015 [14].

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

CONFLICT OF INTEREST

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

ACKNOWLEDGMENTS

The author acknowledge Prof. Michael Brauer from the University of British Columbia for providing the gridded air pollution data of GBD 2019. HA is supported by Novo Nordisk Foundation Challenge Programme: Harnessing the Power of Big Data to Address the Societal Challenge of Aging (NNF17OC0027812).

REFERENCES

1. Murray, CJL, Aravkin, AY, Zheng, P, Abbafati, C, Abbas, KM, Abbasi-Kangevari, M, et al. Global burden of 87 Risk Factors in 204 Countries and Territories, 1990-2019: a Systematic Analysis for the Global Burden of Disease Study 2019. *Lancet* (2020) 396(10258):1223–49. doi:10.1016/S0140-6736(20)30752-2
2. Xu, R, Rahmandad, H, Gupta, M, DiGennaro, C, Ghaffarzadegan, N, Amini, H, et al.Weather, Air Pollution, and SARS-CoV-2 Transmission: a Global Analysis. *Lancet Planet Health* (2021) 5(10):e671–e80. doi:10.1016/S2542-5196(21)00202-3
3. Brauer, M, Casadei, B, Harrington, RA, Kovacs, R, Sliwa, K, Davaakhuu, N, et al. Taking a Stand against Air Pollution - the Impact on Cardiovascular Disease. *Eur Heart J* (2021) 42(15):1460–3. doi:10.1093/eurheartj/ehaa1025
4. Wu, X, Nethery, RC, Sabath, MB, Braun, D, and Dominici, F. Air Pollution and COVID-19 Mortality in the United States: Strengths and Limitations of an Ecological Regression Analysis. *Sci Adv* (2020) 6(45):eabd4049. doi:10.1126/sciadv.abd4049
5. World Health Organization. *WHO Global Air Quality Guidelines: Particulate Matter (PM2.5 and PM10), Ozone, Nitrogen Dioxide, Sulfur Dioxide and Carbon Monoxide*. Geneva: World Health Organization. (2021).
6. Dominici, F, Schwartz, J, Di, Q, Braun, D, Choirat, C, and Zanobetti, A. *Assessing Adverse Health Effects of Long-Term Exposure to Low Levels of Ambient Air Pollution: Phase 1. Research Report 200*. Boston, MA: Health Effects Institute. (2019).
7. Brunekreef, B, Strak, M, Chen, J, Andersen, ZJ, Atkinson, R, et al. *Mortality and Morbidity Effects of Long-Term Exposure to Low-Level PM2.5, BC, NO2, and O3: An Analysis of European Cohorts in the ELAPSE Project. Research Report 208*. Boston, MA: Health Effects Institute. (2021).
8. Brauer, M, Brook, JR, Christidis, T, Chu, Y, Crouse, DL, Erickson, A, et al. *Mortality–Air Pollution Associations in Low-Exposure Environments (MAPLE): Phase 1. Research Report 203*. Boston, MA: Health Effects Institute. (2019).
9. Shaddick, G, Thomas, ML, Amini, H, Broday, D, Cohen, A, Frostad, J, et al. Data Integration for the Assessment of Population Exposure to Ambient Air Pollution for Global burden of Disease Assessment. *Environ Sci Technol* (2018) 52(16):9069–78. doi:10.1021/acs.est.8b02864
10. Chang, K-L, Cooper, OR, West, JJ, Serre, ML, Schultz, MG, Lin, M, et al. A New Method (M3Fusion V1) for Combining Observations and Multiple Model Output for an Improved Estimate of the Global Surface Ozone Distribution. *Geosci Model Dev* (2019) 12(3):955–78. doi:10.5194/gmd-12-955-2019
11. Larkin, A, Geddes, JA, Martin, RV, Xiao, Q, Liu, Y, Marshall, JD, et al. Global Land Use Regression Model for Nitrogen Dioxide Air Pollution. *Environ Sci Technol* (2017) 51(12):6957–64. doi:10.1021/acs.est.7b01148
12. Hoffmann, B, Boogaard, H, de Nazelle, A, Andersen, ZJ, Abramson, M, Brauer, M, et al. WHO Air Quality Guidelines 2021–Aiming for Healthier Air for All: A Joint Statement by Medical, Public Health, Scientific Societies and Patient Representative Organisations. *Int J Public Health* (2021) 66(88). doi:10.3389/ijph.2021.1604465
13. Andersen, ZJ, Gehring, U, De Matteis, S, Melen, E, Vicedo-Cabrera, AM, Katsouyanni, K, et al. Clean Air for Healthy Lungs - an Urgent Call to Action: European Respiratory Society Position on the Launch of the WHO 2021 Air Quality Guidelines. *Eur Respir J* (2021) 58:2102447. doi:10.1183/13993003.02447-2021
14. Lim, SS, Allen, K, Bhutta, ZA, Dandona, L, Forouzanfar, MH, Fullman, N, et al. Measuring the Health-Related Sustainable Development Goals in 188 Countries: a Baseline Analysis from the Global Burden of Disease Study 2015. *Lancet* (2016) 388(10053):1813–50. doi:10.1016/S0140-6736(16)31467-2