



# An assessment of perceptions of air quality surrounding the implementation of a traffic-reduction measure in a local urban environment

Seán Schmitz<sup>a,\*</sup>, Laura Weiland<sup>a</sup>, Sophia Becker<sup>a</sup>, Norman Niehoff<sup>b</sup>, Frank Schwartzbach<sup>b</sup>, Erika von Schneidemesser<sup>a</sup>

<sup>a</sup> Institute for Advanced Sustainability Studies, Potsdam, Germany

<sup>b</sup> Department of Urban Planning, Urban Renewal, and Traffic Development, Landeshauptstadt Potsdam, Potsdam, Germany

## ARTICLE INFO

### Keywords:

Air quality  
Perception  
Sustainable urban transport  
Spatial analysis  
Local  
Transdisciplinary

## ABSTRACT

Poor air quality remains a major environmental and health risk in Europe, despite improvements over the last few decades. Consistent exceedances of the nitrogen dioxide air quality limit values at a roadside monitoring station in Potsdam, owing to heavy local and commuter individual motorized traffic, prompted the city administration to implement a trial traffic measure aimed at reducing motorized traffic to improve air quality. This study analysed data ( $n = 3553$ ) from a questionnaire carried out prior to the implementation of the trial traffic measure. This research provides a case-study to contribute to the understanding of general determinants of air quality perceptions, and policy-relevant information regarding how citizens perceive air quality in the context of a 'hard' policy measure. A subset of variables was used to build an ordinal logistic regression model to assess the explanatory power for air quality perceptions. Gender, perceived health status, level of concern for air quality, level of concern for climate change, and the desire for greater access to information regarding air quality were factors found to be significant in their explanatory power of perceptions of air quality. The results are discussed in the broader policy context of attempts to improve air quality in urban environments.

## 1. Introduction

### 1.1. Air pollution

Air pollution is a substantial problem that continues to threaten public health and contributes to climate change. Pollutants such as particulate matter with an aerodynamic diameter smaller than  $2.5 \mu\text{m}$  ( $\text{PM}_{2.5}$ ), nitrogen oxides ( $\text{NO}_x$ ), and tropospheric ozone ( $\text{O}_3$ ) continue to be a cause of cancer, respiratory and cardiovascular disease, and premature death (EEA, 2016). Poor air quality is detrimental to human health, with a number of studies finding short-term and long-term pulmonary and cardiovascular health effects of  $\text{PM}_{10}$  and  $\text{PM}_{2.5}$  (Rückerl, Schneider, Breitner, Cyrus, & Peters, 2011). Air pollution also incurs major economic costs to the European Union, on the order of billions of Euros a year (EEA, 2016). Additionally, air quality and climate change are connected, in that a number of air pollutants are also short-lived climate forcers. Attempts to tackle issues of poor air quality often have the additional benefit of mitigating climate change (Kopp, Mauzerall, Chameides, & Wilson, 2010; Melamed, Schmale, & von Schneidemesser, 2016).

A variety of different policy measures are currently being

implemented across Europe aimed at reducing air pollution. As a major source of air pollution is the transport sector, many policies are targeting this area for improvement. Road transport is the largest source of  $\text{NO}_x$  emissions in the EU, accounting for 39% of total emissions in 2015, and is also a minor source of  $\text{PM}_{10}$  and  $\text{PM}_{2.5}$  emissions, contributing 13% to each in 2015 (EEA, 2017). Cities, as hotspots for air pollution with higher emissions from transport than the EU average (Mayer, 1999), are thus making important strides by implementing a variety of urban access regulations that impose restrictions on traffic in demarcated areas. These include urban road tolls, low emission zones (LEZs), and key access regulation schemes (European Commission, 2016). Particularly in Germany, exceedances of  $\text{NO}_2$  limit values at roadside air quality monitoring stations are a major challenge due to the high proportion of diesel vehicles on the road, with 'hard' policy measures currently being considered to address the issue. For example, the German federal court recently ruled that the implementation of bans on diesel vehicles from entering highly-polluted areas of cities as a last resort to meet EU air quality regulations is legally acceptable (Bundesverwaltungsgericht, 2018).

Potsdam, the capital city of the federal state of Brandenburg, Germany, recently implemented its own trial traffic measure to improve

\* Corresponding author at: Institute for Advanced Sustainability Studies e.V. (IASS), Berliner Straße 130, 14467 Potsdam, Germany.  
E-mail address: [Sean.Schmitz@iass-potsdam.de](mailto:Sean.Schmitz@iass-potsdam.de) (S. Schmitz).

air quality at its southwestern principal access route: the Zeppelinstraße. The Zeppelinstraße is a highly-frequented street in the city that has for years been exceeding safe thresholds of air pollutants. In 2016, the Zeppelinstraße air quality monitoring station recorded a yearly average value for NO<sub>2</sub> of 43 µg m<sup>-3</sup>, exceeding the EU and World Health Organization (WHO) limit-values of 40 µg m<sup>-3</sup> (Landesamt für Umwelt, 2016). This infringement of EU air quality regulations has continued on the Zeppelinstraße for more than a decade. On an average weekday, the street can experience between 18,000 and 35,000 cars traveling through, about half of which is commuter traffic from neighbouring regions and not from Potsdam itself (Mobil in Potsdam, 2017). The trial implementation of a measure to reduce individual motorized traffic (see Section 2.1. for more details) began in July of 2017 and continued for 6 months, through December 2017, with the possibility to extend indefinitely depending on its success in reducing roadside air pollution levels (Mobil in Potsdam, 2017).

### 1.2. Perceptions of air quality and air pollution

In the last two decades, a variety of studies have been conducted investigating the perceptions of air quality in cities all around the world. Sociodemographic factors such as age, gender, education, and health status have been found to be correlated with perceptions of air quality (Oltra & Sala, 2014). Guo et al. (2016) found that, in their sample, those respondents over the age of 40, with a college-level education, living in an urban residential area, or with a child in poor health condition were more likely to perceive the air quality to be poor. Several studies have found women to be more likely to acknowledge that air pollution will lead to adverse health effects or to perceive the air quality as poor compared with men (Elliott, Cole, Krueger, Voorberg, & Wakefield, 1999; Howel, Moffatt, Bush, Dunn, & Prince, 2003; Jacquemin et al., 2007). Health status was found to be associated with perceptions by Jacquemin et al. (2007), where people with respiratory symptoms such as night dyspnoea and phlegm reported higher levels of annoyance from air pollution. Howel et al. (2003) also found some weak associations between people with chronic illness status and perceptions of disease affected by air pollution.

A set of contextual factors includes urban and rural settings and proximity to industry (Howel et al., 2003; Oltra & Sala, 2014). Respondents living closest to heavy industry (steel and petrochemical plants) were more likely to rate air quality as poor in their neighbourhood, whereas those living farthest away tended to disassociate their neighbourhoods with air pollution and poor air quality (Howel et al., 2003). A similar dichotomy between urban and rural settings was found in Brody, Peck, and Highfield, (2004), where respondents living in rural settings perceived the air quality to be better than those living in urban settings. This supports the common finding that respondents have a perception of rural settings being 'safe' spaces with unpolluted air to which urban residents can escape (Smallbone, 2012).

A smaller subset of these studies used Geographic Information Systems (GIS) techniques to analyse perceptions of air quality in a spatial context. GIS tools allow for a more precise exploration of spatial patterns of air quality perceptions. Brody et al. (2004) conducted surveys in Houston and Dallas, Texas, USA, in which they asked respondents to rate air quality on a Likert scale from 1 (very bad) – 7 (very good). These responses were then allocated spatially to the zip codes in which respondents' addresses fell and averaged to produce an overall measure of air quality perception by zip code in both cities. The generation of maps based on these responses showed the spatial differences in perceptions across each city, with respondents from urban areas perceiving the air quality to be worse than those from rural areas. In a similar study, Mally (2016) mapped perceptions of Ljubljana, Slovenia but instead of using postal codes, used respondents' addresses to spatially depict perceptions of air quality across the city at a higher resolution. The study also found that a higher proportion of residents in the city center than in outer districts perceived air pollution to be

problematic.

With air quality remaining a significant challenge to cities in Europe, it is important to produce policy-relevant research that can help guide decision-making towards making cities healthier, more accessible, and, ultimately, sustainable. This, however, remains a major challenge in cities and significantly more needs to be done to address urban transport and transition to sustainable urban mobility (Banister, 2011), particularly concerning the integration of urban planning with transportation infrastructure (Hickman, Hall, & Banister, 2013). This study seeks to add not only to previous literature on perceptions of air quality, but to provide policy-relevant information useful to the city of Potsdam during their implementation of traffic measures to improve air quality, with broader implications for cities across Germany struggling with similar challenges. This paper follows the working hypotheses that: (i) perceptions of air quality vary spatially across Potsdam, Berlin, and Brandenburg; (ii) respondents' environmental concern is significantly associated with their perceptions of air quality; and (iii) age, gender, income, health status, and education are significantly associated with respondents' perceptions. Finally, the results are discussed in the broader context of the policy implications – not only for Potsdam, but more broadly for cities in Germany and Europe.

## 2. Materials and methods

### 2.1. Context: trial implementation of a traffic measure

This study was conducted during the trial implementation of a traffic measure in Potsdam aimed at improving roadside air quality by reducing individual vehicular traffic. The Brandenburg Ministry for Rural Development, Environment and Agriculture (MLUL) is the responsible authority for Potsdam's Air Quality Plan and therefore advised the city administration to implement a measure to improve air quality and address NO<sub>2</sub> exceedances on the heavily trafficked Zeppelinstraße. In response, the city parliament (Stadtverordnetenversammlung) approved the implementation of a trial traffic measure with the following changes to infrastructure and mobility services (i) the Zeppelinstraße was reduced from a four-lane road with two-way traffic down to a two-lane road, with some sections containing a third lane for turn-offs; (ii) the additional space was allocated as a right-turn lane, a dedicated bike lane (with corresponding sections that were previously a shared bike/pedestrian area, thereby also improving the pedestrian infrastructure), and as a bus lane; (iii) the frequency of bus service along the main route traversing the street was increased from 4 to 6 trips per hour; (iv) pedestrian "islands" were built to better facilitate pedestrian crossings; and (v) more park and ride infrastructure connecting to the city's tram network was provided.

The infrastructural changes aimed to discourage individual motorized driving and increase the modal share of alternative forms of urban mobility – especially walking, cycling, and public transport. As such, it directly affected commuters living outside and working inside Potsdam or Berlin, as well as residents of Potsdam. The public was informed about the intervention through TV, radio, newspapers, and leaflets that indicated the objectives of the measure and when and where it would take place. Public engagement in the decision-making process was limited, but was more generally integrated into the development of the air quality plan.

### 2.2. Data collection

In June of 2017, one month prior to the implementation of the 6-month trial traffic measure, an online survey was conducted by the Institute for Advanced Sustainability Studies (IASS e.V.) to assess various aspects of public perceptions regarding not only the traffic measure itself, but also the topics of sustainable mobility and air quality. The questionnaire was developed in collaboration with the Potsdam city council (Landeshauptstadt Potsdam), specifically the traffic

Download English Version:

<https://daneshyari.com/en/article/6775118>

Download Persian Version:

<https://daneshyari.com/article/6775118>

[Daneshyari.com](https://daneshyari.com)