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Title: Black carbon as a new air quality and health indicator of limited traffic zone (LTZ) interventions: The results of the 'Area C' monitoring campaigns at residential and kerbside sites in Milan, Italy

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Body: Background. An air quality monitoring project was carried out in 2012 to assess environmental and health effects of Milan 'Area C' LTZ. It was based on measurements of Black Carbon (BC) particles, a suitable metric for traffic pollution. Aims. To evaluate the environmental and health potential effects of the Area C LTZ. Methods. BC, PM10 and PM2.5 real-time 2 weeks measurements were performed in and outside LTZ in different seasons, both at residential and kerbside sites, BC measured by Aethalometers (Magee, USA) and PM by Aerocets (MetOne, USA). Results. At kerbside sites in summer, during working days with LTZ in force, in and outside Area C 24h mean (SD) BC concentrations were 2.5 (0.6) ug/m3 and 4.7 (2.1) ug/m3 respectively ($p < 0.0001$), which represents an absolute difference of 2.2 (1.7) ug/m3 or -47% inside LTZ as compared to the outside area. BC/PM10 and BC/PM2.5 ratios were 55% and 64% lower inside LTZ. At third floor residential sites, in winter season, in and outside Area C 24h mean (SD) BC concentrations reached a value of 5.6 (1.9) ug/m3 and 7.8 (2.5) ug/m3 respectively ($p < 0.0001$), with an absolute difference of 2.2 (1.3) ug/m3 or -28% in the LTZ. BC/PM10 and BC/PM2.5 ratios were 32% and 25% lower inside LTZ. No statistically significant changes were found in PM10 and PM2.5 concentrations. Conclusions. A significant difference was found in BC concentrations inside 'Area C' LTZ, with an improvement of one to two BC epidemiological change units, a remarkable reduction in particulate toxicity and related expected mortality and morbidity.