Clean Construction Practices at Hospitals Improve Public Health

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Diesel exhaust has been linked to numerous health issues, especially for people with respiratory and cardiovascular conditions. The Clean Construction Partnership encourages health systems to use low-emission construction equipment and reduce idling at their construction sites. Every dollar spent on reducing diesel pollution results in $13 in public health benefits [1].

Taking care of the environment is beneficial for every individual who lives in the community. That is why progressive health systems are making clean air construction practices a priority.

In 2017, Novant Health and Atrium Health (formerly Carolinas HealthCare System) partnered with Medical Advocates for Healthy Air (MAHA), a program of Clean Air Carolina, to launch the Clean Construction Partnership. This partnership resulted from discussions over a number of years with physicians from Mecklenburg County Medical Society and MAHA about the need to address the risks associated with diesel emissions at hospital construction sites.

Why Hospitals Need a Clean Air Policy

Construction is common at hospitals. Health systems are regularly expanding or renovating facilities to address their growing needs and improve the care they provide. Every day, individuals from all walks of life visit hospitals and care facilities. It may be for their own health care, to visit someone they know who is undergoing treatment, or to go to work. When people walk by construction sites, they are exposed to diesel exhaust and other air pollutants that cause adverse health outcomes and exacerbate ongoing diseases [7]. The case for implementing a clean construction standard is very clear.

Diesel particulate matter may linger in the atmosphere around combustion areas, such as construction sites, contaminating the air and resulting in exposure long after the machines are turned off [2]. Reducing this source of pollution protects the health of persons visiting, working, and staying at the hospital. The US Environmental Protection Agency (EPA) estimates that every dollar spent on reducing diesel pollution results in $13 in public health benefits [1].

The Health Risks Involved

The combustion of diesel fuels produces particulate matter, a toxic blend of fine and microscopic particles, and nitrogen oxides, a component of smog and an ozone precursor [2]. Diesel exhaust contains more than 40 toxic pollutants and is designated as a carcinogen by the World Health Organization [3], National Toxicology Program [4], EPA [5], and the National Institute of Occupational Safety and Health [6].

This particulate matter poses a significant health risk as some of the particles are small enough to evade the body's respiratory protections, enter deep into the lungs, and pass into the bloodstream, impacting the cardiovascular system [7]. Both short-term and long-term exposures to particulate matter have been shown to have adverse health effects. Acute exposure to particulate matter can cause irritation of the eyes, nose, throat, and lungs [5]; coughing, wheezing, and aggravation of existing respiratory conditions, such as chronic obstructive pulmonary disease (COPD) and asthma; lung inflammation; reduction in lung capacity [8]; nausea and vomiting [9]; neurological effects including headaches, numbness, weakness, and dizziness [9]; and exacerbation of cardiovascular diseases and stroke [10].

Chronic exposure to particulate matter can lead to acute issues as well as other effects such as lung cancer, mental health effects, and reproductive and developmental effects [4, 11, 12]. Furthermore, recent studies have indicated that short-term and long-term exposure to particulate matter and ozone below the current federal standards could cause morbidity and mortality [13, 14]. Exposure to these particles threatens the health of hospital team members, patients, and visitors.

Many studies have found a connection between air quality and human health. High-pollution "ozone alert" days can increase breathing problems for patients with asthma or other respiratory conditions. Populations at risk on these

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days are babies, children, adults who exercise and work outside, athletes, and older adults. Others at risk are people with respiratory conditions, such as asthma and COPD, and people with cardiovascular disease and diabetes [15]. Some are at risk because of their underlying chronic state while others spend long periods of time outside.

The frequency of emergency department visits and hospitalizations due to respiratory conditions has been linked to short- and long-term ozone exposure [16]. At-risk populations exposed to air pollution may seek care for several common conditions that can worsen with ozone exposure including lung and throat irritation and inflammation, chest pain, wheezing, coughing, difficulty breathing, and asthma symptoms. In fact, short-term ozone exposure has been linked to hospitalizations and deaths, especially for cardiovascular and respiratory conditions [16]. In 2015, more than 3,600 people died from asthma complications, according to the Centers for Disease Control and Prevention [17].

As the Hippocratic Oath says: "I will prevent disease whenever I can, for prevention is preferable to a cure." It's important to help an individual patient recover from a triggered attack; it can be just as important to care for the environment in an effort to prevent the triggers in the first place.

How Hospitals Can Help Reduce Pollution

Construction equipment is the second largest source of nitrogen oxide (NO_x), which contributes to ground-level ozone pollution [17, 18]. By reducing patient exposure to particulate matter and ozone, health care systems could reduce readmissions and save more lives.

The black carbon in diesel exhaust is one of the largest contributing pollutants to climate change [19]. The American Public Health Association and other professional societies have called climate change a major public health issue and have encouraged public health professionals to take action to reduce climate change pollutants [20]. Climate change can worsen air and water quality and increase infectious diseases, extreme weather events, and allergens [20]. Reducing diesel emissions will allow health care systems and other businesses to show tangible results in helping mitigate climate change and improving the health of their communities.

Since diesel engines are a major contributor to both ground-level ozone and particulate matter pollution, the EPA adopted rules in 1994 to reduce emissions from on-road and off-road diesel engines [21]. These rules phased in new engine standards based on horsepower over a 16-year period. Engines manufactured in 2007 for on-road vehicles, such as trucks and buses, and engines manufactured in 2010 for off-road equipment including bulldozers, forklifts, and excavators, had to meet EPA Tier 4 standards, which require more efficient and lower emission engines. All newly manufactured engines in 2014 had to meet what EPA calls Tier 4 Final standards, integrating engine and fuel controls as a system to gain the greatest emission reductions [21].

The US made extraordinary reductions in air pollution between 1996 and 2014—approximately a 96% reduction for both particulate matter and nitrogen oxide (NO_x), a major contributor to ozone pollution [22]. These new, stronger standards represented a major win for cleaner air and better public health. But since diesel engines can last up to 30 years, many older diesels will continue to pollute for decades [23]. This is why it is necessary for health care systems to be leaders in implementing clean construction standards; while systems do not own the construction equipment themselves, they do have the power to influence contractors' decisions.

To improve air quality and public health, the Clean Construction Partnership recommends that hospital systems and other businesses require all off-road equipment used on construction projects to meet EPA Tier 4 Final standards and provide education, installation of signage, and a penalty system to reduce unnecessary idling by operators of off-road equipment. The Clean Construction Partnership drafted a clean construction standard that incorporates these recommendations, which will reduce exposure to air pollutants and their adverse effects on the health of the patients and care teams. Examples of clean construction standards can be viewed on MAHA's website [24].

Earlier this year, both Novant Health and Atrium Health implemented a clean construction standard that requires the use of EPA Tier 4 low-emission equipment and limits unnecessary idling. By adopting this standard, they are improving the quality of care provided to patients and residents of nearby neighborhoods.

Best Practices at Novant Health

As a leader in the health care industry, Novant Health 2 years ago implemented clean air initiatives to decrease diesel pollution at its construction sites. Novant Health was the first health system in the Carolinas to take steps to minimize construction pollution. In 2016, the construction of the Women's Center at Novant Health Matthews Medical Center became a best practice model to follow. For this project, 2 contractors—Rodgers Builders and R.J. Leeper Construction—teamed up to make clean air a priority. Before breaking ground, the 2 firms met with Novant Health officials and Clean Air Carolina to discuss ways to reduce diesel emissions.

The question asked was: How can we minimize the diesel emissions that contribute to ozone and particle pollution? Rodgers Builders and R.J. Leeper Construction agreed to track each piece of heavy duty equipment that came on site to determine its EPA Tier level. Two goals were established: Use as many new, low-emitting pieces as possible and post signs around the construction site to discourage idling, which expels unnecessary exhausts, contributing to pollution.

Two measurable results worth noting for this construction project were: 1) 86% of all equipment used was ranked

low emissions (Tier 3 or Tier 4) by the EPA, and 2) the estimated amount of fine particle pollution was reduced by 33% when compared to a baseline number for the project.

The same practices were used for the new addition at Novant Health Clemmons Medical Center in 2017 as well as at the current construction site for Novant Health's newest hospital in Mint Hill. By taking these steps, Novant Health significantly reduced the amount of particle pollution associated with its construction projects. Novant Health continues to work with Clean Air Carolina to explore additional measures that can improve air quality at construction sites.

Conclusion

Now is the time to address construction site air pollution to protect everyone in the community. Medical Advocates for Healthy Air, Novant Health, and Atrium Health invite health care systems across North Carolina to join the Clean Construction Partnership. Better air quality at construction sites is a major victory for public health. It is a win for patients, hospital visitors, health care staff, construction workers, and neighbors—everyone who makes up the communities served. Being a good environmental steward and advocate for clean air is the right thing to do. NCMJ

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