

How dangerous is the use of oxygen in the home?

By John R. Goodman BS RRT

Although oxygen was discovered around 240 years ago, its use in the home to treat patients with lung disease only goes back 50 years or so. Oxygen is a tasteless, colorless, odorless gas that makes up about 21% of the air we breathe. But we know from ice core studies, and from measurements made off ancient charcoal deposits that this was not always the case. Let's take a minute to review the common terminology used when it comes to oxygen percentage.

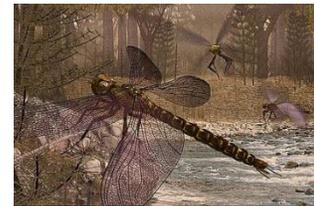
Remember the term FIO_2 from earlier chapters? This is an abbreviation for "Fraction of Inspired oxygen." It is simply the percentage of oxygen found in our atmosphere. So, correspondingly, the FIO_2 of the air we breathe is rounded up (from 20.95%) to 21%. As noted above this has not always been the case. In the early evolution of the earth, the FIO_2 was as low as 12% at one point, and about 300,000,000 years ago it was as high as 35%.



Huge reptiles flourished
in higher O_2 atmosphere



Gigantic flying lizards
Wing span 18 feet



Enormous dragonfly
Wing span 30 inches

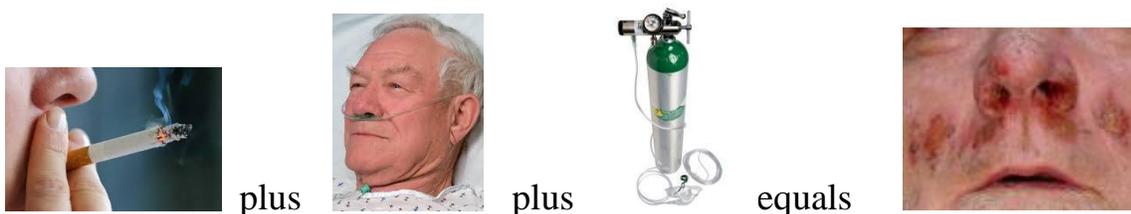
In fact, strong cases for the gigantic reptiles, birds, and insects of the "Carboniferous" period are based on the fact that so much oxygen was available to fuel the metabolism necessary to create huge species of certain animals and insects. We know this from the fossil record. Somewhere around 250,000,000 million years ago one of several "great dying" episodes occurred and at this point the FIO_2 of the earth's atmosphere was somewhere near 12%. This would be the roughly the equivalent of living at an altitude of 17,400 feet. In fact, it is almost impossible to start a fire with the FIO_2 lower than about 15%. But while this is interesting history, the current FIO_2 of 21% has been pretty constant for the last 40,000,000 years.

As we all know, statistics can be used to support almost any position. But *sometimes* statistics are just what they are reported to be. Since the number of patients on home oxygen in the United States has edged up to somewhere around 2,000,000, it would seem that now might be a good time to review the statistics that *have* been reported on the number of fires caused by patients who continue to smoke while on nasal oxygen.

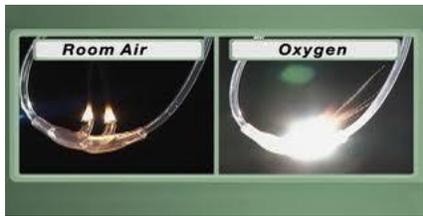
What percentage of patients continue to smoke with oxygen in their home? Well, I am sure most of you aren't naive enough to think it approaches 0%. In fact, the National Fire Protection Association (NFPA) has looked very closely at this small sub section of all patients. A number of surveys from both the United States and countries all around the world have given us a range of patients on continuous oxygen who continue to smoke from a low of 5% to a high of 43%. The average of all these surveys seems to be around 30%. So if we use 30% as a pretty hard number and 2,000,000 as the total number of patients receiving home oxygen then a staggering 600,000 patients continue to smoke while on oxygen!

Back in 2008 the NFPA did a very thorough and exhaustive study on fires and burns that involved home medical oxygen. In March, 2010 the Veterans Administration published a paper that discussed the ethical considerations that may arise when a VA home care patient on LTOT continues to smoke. Also, a number of well respected manufacturers of home oxygen equipment have developed white papers on looking at ways to reduce fires and burns from patients who continue to smoke while using medical oxygen. Since these papers run into the hundreds of pages, I'd like to approach this as a sort of a "greatest hits" album. That is, let me share the known facts with you and let the statistics do the talking.

Between the years 2003 and 2005, US fire departments responded to an average of 182 home fires per year in which oxygen equipment was involved. Sadly, 46 people died in these fires. Additionally, 1190 thermal burn patients were seen each year by emergency room personnel. By far the highest percentage of patients seen in the emergency room were related to smoking at 73%. Another 10% were due to the stove or oven, and 9% due to candles.



In addition to the 46 deaths per year, there were also 60 innocent civilian injuries per year. In this group *one in every four fires resulted in death*. It is easy to underestimate just how much more vigorously a flame will burn in an oxygen enriched atmosphere. It is also easy to overlook the fact that the oxygen the patient is receiving through a simple nasal cannula will also increase the amount of oxygen in the patient's hair, eyelashes, eyebrows, clothes, beard, bed clothing, drapes, couch upholstery etc. It is true that oxygen will not explode by itself, but it will make the fire burn hotter and faster.



Easy to see the difference



89% of burns are facial.



Signs do not seem to work.

Although the NFPA data is almost 6 years old, we can extrapolate that the number of fires can only have increased during this period of time. A reader might wonder why the total number of reported emergency room visits and deaths is so low when compared to the total number of patients on oxygen who continue to smoke. Well, the answer also lies in the statistics. Obviously, the NFPA couldn't possibly survey all 6000+ hospital emergency rooms in the United States. They relied on other data supplied by a myriad of government agencies. By their own admission it represents perhaps 10% of the nation's fire departments. Also, the total number of unreported burns is widely believed to be grossly underestimated. Since facial burns represent 89% of all thermal burns, many patients are able to quickly remove their nasal cannula and extinguish any fire. It is very likely that these same patients never notify fire authorities, and in many cases don't even show up at the local emergency department. They may be reluctant to report these incidents due to sheer embarrassment, or in the case of other property damage, may not want to take any responsibility for the incident since they were in all likelihood informed of the possible fire danger before the fire. For what it's worth in deaths and injuries, males outnumbered females 3-2. By far, most fires started in the patients bedroom (58%) followed by the living room or den (30%)



Cylinders CAN and do explode.



The more cylinders the the worse the fire.



The absolute worst possible place to have an oxygen enriched fire!

Patients who continue to smoke may also cause injury or even death of life partners, roommates, innocent civilians, and of course firemen and first responders. Oxygen cylinders have been documented to explode much like a bomb or act like a torpedo. With such destructive possibilities, it would seem that any and every

patient on home oxygen for any reason, should be well known to the local fire department. In fact, very strict codes for the use and storage of medical oxygen in all health care facilities have been in place for many years. *Oddly, this is not the case for home oxygen.* Outside of posting the very clear OXYGEN IN USE sign on the front door of the domicile, there do not appear to be any federal regulations limiting (for example) the number of oxygen cylinders a patient can have in their home at any one time. Many patients have multiple full small (E) cylinders of oxygen to get them through power failures, or major storm interruptions of service. As a matter of fact, there doesn't seem to be ANY laws requiring local oxygen supply companies to alert local fire departments that a new oxygen patient was just set up in their service area! A number of states have tried from time to time to tighten up the communication lines between oxygen patients and local fire authority, but recent HIPPA rules have made this legislation very difficult to pass.

The Veterans Administration estimates that they have perhaps 110,000 veterans on home oxygen. Thus, statistically about 36,000 continue to smoke. The VA has initiated a directive aimed at reducing the fire hazards associated with smoking while oxygen treatment at home is expected. Their "Harm Reduction Strategies" include:

1. A fire risk assessment and reassessment with any change in prescription.
2. Assessment of compliance at least every 6 months.
3. Working smoke detectors.
4. Educational and/or warning information for the patient and others.
5. Counseling for non-compliant patients.
6. Documentation for all close calls and adverse events.
7. Referral to ethics consultation and multidisciplinary consideration for difficult cases.

So, given the statistics and the growing baby boomer demographic, it would seem some sort of improved communication channel should be established. If they can put baby monitors in nearly every crib just to know when the baby is crying, surely some sort of centralized system could be established between oxygen suppliers and local fire departments. The safest way to cut down on home oxygen fires is of course, smoking cessation. But, according to latest statistics only 3% of smokers who attempt to quit are successful at the 12 month mark.

Obviously patient education is key, and especially important if English is not the primary language spoken in the household. Educational DVD's may be helpful for those with reading difficulties. Secondary measures such as smoke alarms and fire extinguishers can only help with fires already started, but do nothing to prevent them from starting in the first place.

Smoking is the number one cause of death in home fires and 7% of the estimated 680 home fire deaths are related to oxygen therapy equipment. The decision to remove oxygen equipment from a patient who needs oxygen, but continues to smoke presents a moral and ethical dilemma. Some countries (Australia) have already moved in this direction. These highly charged situations and factors will always need to be analyzed on a case by case basis. But seriously, who is actually going to remove oxygen equipment from a patient's house, when they have already met all the criteria for continuous oxygen therapy?



Permanent signs can be ordered on the web



Close up of sign



Whatever you do...

Does your local fire department know you are on oxygen?????