Key points:

- Spaying always takes precedence over neutering in free-roaming populations
- Neutering of males has no effect on total population numbers nor turnover in free-roaming populations
- Within a closed household, the numbers of females and males should dictate whether to spay or neuter

Considering the limited resources available on the reservations and worldwide in general, spaying for general population control measures is ineffective in free-roaming populations. Within a small community or household, however, the situation becomes more complicated. Since unwanted litters effectively end up as part of the free-roaming population or competing for limited shelter and foster space, deciding whom to surgically "fix" is important if there is a large-scale effort to remove free-roaming animals but our human and financial resources are limited. In some cases, even though the overall dog or cat population might not change from carrying capacity, there may be an animal control agency literally rounding up and killing animals en masse, or someone intentionally placing poison out for feral animals. In these cases it may be in the best interest to try and minimize any further household additions to the feral populations, but even in normal circumstances we need to decide how to best use limited available surgery spaces in the most efficient way possible.

For example, let's say that a mobile spay / neuter unit can accommodate 100 surgeries a day, but the local community has 200 owned dogs divided into various households. If a household has young intact females that free roam, these are the logical first choice

for any surgery space since they will roam, get pregnant, be more likely to successfully deliver their puppies, and will get pregnant again. An 8 year old free-roaming female (rare on the reservation since being hit-by-care, shot, poisoned, etc. are all relatively common) is less of a priority. A female with obvious TVT might take precedence to decrease the spread of TVT. If the decision to neuter males is made, a free-roaming male with obvious TVT might jump to the top of the list

Now assume an owner shows up with 4 dogs, none of whom are allowed free-roaming and instead live in a fenced yard. The actual breakdown of the female:male ratio becomes important if our resources are limited. Although spaying females is our priority, in a household with 3 intact females and 1 intact male, the best use of limited surgery availability might be to neuter the sole male. In a split household, the focus goes back to females, especially young females.

Further, the decision as to which households to start with may depend on the specific history. If a household has new litters of puppies every year that consistently have deaths from parvo, spaying or neutering these dogs will take a high priority since the parvovirus can survive for months to years in the environment and can not be effectively removed from the premises. All future litters will risk exposure, and no vaccine protocol can fully remove the risk to puppies in the 8-16 week period in which maternal antibodies wane. Removing the possibility of future litters in this household may not change the total population at large but will reduce preventable deaths. So, in the end, a random, first-come first-serve approach to spay and neuter might seem to be the most fair to the owners, but may not be the most efficient use of limited resources.

Outside of the household, and in free-roaming populations, spaying of females should take highest priority if a spay / neuter program is being considered. Multiple studies outside the USA have demonstrated the obvious, that from a population standpoint, male neutering is a non-issue and that any surgical efforts should be focused on young intact females (19). Further, in free-roaming populations worldwide, there are far less females than males, somewhere in the range of 1 female for every 3.2 males, due to the health consequences of

reproduction and post-partum complications (19). Given limited human resources, if surgical population methods are to be pursued, the best use of time and money is thus to spay young females and ignore the much larger population of free-roaming males that are competing for access to the rarer in heat females. Additionally, in many parts of the world, male dogs are more readily adopted, so it becomes in the best interest to further focus any population efforts onto the females.

"ICAM recommends 70% annual female dog sterilization as an optimum coverage for an effective humane dog population management" (19). Given fixed resources, any spay operation that also focuses on males would thus be reducing the total female sterilization percentage, assuming that they are operating within a budget and with a fixed number of surgery slots.

There are medically valid reasons to neuter males on the reservation and in the Third World communities, primarily to decrease the spread of TVT (transmissible venereal tumor), but on an individual level, spaying females makes more sense since it not only reduces TVT but also prevents breast cancer (if done before the first heat cycle) and prevents pyometra (infected uterus), both of which are killers and significantly more common than TVT. Spaying females is getting 3 birds with 1 stone vs reducing only TVT in males, so any organization with limited resources would best serve the dog community by focusing on females.

Additionally, the negative effects of spaying and neutering prepubescent animals should not be disregarded when it comes to males. Spaying or neutering before puberty significantly increases the chance of a cruciate ligament tear in both males and females. For a feral dog or one owned in a remote, poverty stricken area, these cruciate tears will not be surgically repaired and will lead to lifelong debilitation, pain, suffering, and attacks from other animals. In the interest of preventing pyometra, spaying a feral female dog still has positive individual effects (even if population control isn't one of them), and the increased risk of a cruciate tear is likely worth the prevention of pyometra. However, beyond TVT reduction, neutering a male has

very limited health benefits and the increased risk of a cruciate tear should be weighed against the prevalence of TVT in the area.

For truly feral animals, spaying or neutering not only has no effect on overall population, but most will not live long enough to develop cancers of any form (61), so spay / neuter for this purpose has limited to no value.