Key point:

- Cheap, tableside diagnostic testing can be done in the field for the vast majority of cases

The importance of a cost effective approach to diagnostics that can be done table side in a field setting cannot be overstated. In many ways, it is the opposite of university style medicine as taught to veterinary students, where "annual" blood work, urinalysis, and fecal are recommended as "baseline". Veterinary teaching colleges are primarily staffed by specialists from various disciplines, specialists that focus on one core area and frequently only see the rare cases that general practitioners so infrequently encounter that the final diagnosis remains rare and elusive. As such, many veterinary specialists will not even consider looking at a case without these "baseline" tests and then ordering a slew of other tests to find the elusive zebra.. Yet, what percentage of the world's animals have access to even "baseline" medicine?

Consider the financial realities. 75% of dogs (and likely an even larger percentage of cats) in the world are stray. Of the remaining 25% that have owners, what percentage of those have access to veterinarians that have bloodwork, X-ray, or ultrasound capability? Assume for the sake of the argument that 10% of owned animals actually see a vet for these diagnostics, which means 2.5% of dogs and cats in the world even have access to these tests (10% of 25%, i.e.). Of the 2.5% that have access, what percentage of these owners are willing to absorb the cost of these diagnostics tests? Outside of the United States, even if 20% of owners that have access to the "baseline" tests can afford them and are willing to do so, 1/5th of our 2.5 percent is 1% of the total worldwide dog and cat population that will ever receive advanced diagnostics. Many of these numbers are theoretical, but without a doubt, anyone who has worked in field style veterinary medicine on the rez or in remote Third World locations can attest that full lab work and advanced imaging is not pragmatic on a cost level, and in many cases requires the use of outside laboratories with no results provided for immediate use. In some cases, sending off lab work from field locations might require a day or more just to transport lab samples, and more days to wait on results. Finally, it is not unusual to encounter an owner with no phone nor ability to get ahold of once the results are in.

Given the financial reality of putting on a field clinic and seeing 500 cases in a weekend on an extremely tight budget, getting a CBC/chemistry/urinalysis/fecal/radiographs/FAST/TFAST "baseline" is out of the cards. Money spent on “baseline” diagnostic tests is money not available for preventive care. $1000 spent on one case is 286 vaccines not given, or 286 potential parvo and distemper cases that may never receive medical treatment. Saving one at the cost of many others is counter to the very principles of epidemiology.

However, considering our overarching goal of the greatest good for the greatest number, and the fact that common things happen commonly, we can accurately diagnose the vast majority of sick cases using basic and cheap tableside field tests. Most of the sick and injured cases presenting at field clinics will be related to locally common infectious diseases (parvo, distemper, panleukopenia, Ehrlichia, coccidioidomycosis, heartworm disease, etc.) as well trauma related to fights and vehicle injuries.

There will be the occasional random foreign body, pyometra, and other presenting complaint that would be typical in an emergency room setting, but these will be the exception and an astute clinician should look for the proverbial horses first, and then refer out or take the remaining zebras to local clinics (if possible) after no horses can be found. Fortunately, multiple cheap options to rapidly diagnose are available.

CBC / Chemistry Panel: Multiple options to approximate a CBC/chem panel are available that are basic but effective and cheap.

CBC: Instead of an automated CBC, a tableside blood smear and manual PCV will give the same information for free. Further, blood borne and intracellular parasites common on the rez (eg. Ehrlichia) can be identified by direct visual exam. Blood smears preceded the advent of computerized CBCs and in the hands of a trained individual are free, quick, and accurate.

Chemistries: A standard inhouse basic chemistry includes renal values, hepatic values, blood sugar, and occasionally electrolytes. The basics can be approximated fieldside as follows:

Glucose: A handheld glucometer for an accurate glucose reading for about $1 at the time of this writing (2022).

Renal (BUN / CREA): An Azostix reagent strip can be used on whole blood for an evaluation of the degree of azotemia (if present). For practical purposes, an azostrip gives a BUN reading with about a 25mg/dl range, which is sufficient to either rule out azotemia or to give an idea of the degree. There are exceptions (low BUN, high CREA), but an azostrip combined with a USG and urine protein strip can effectively rule out kidney disease in the vast majority of cases, effectively for under $2.

Hepatic (ALT/AST/TBili): A thorough physical exam should be able to detect icterus, which should detect most hepatic disease if IMHA (Immune mediated hemolytic anemia, aka Autoimmune hemolytic anemia) is ruled out via PCV/blood smear. Granted, not all hepatic cases will be detected, but use of a portable ultrasound can further the clinician's diagnostic ability fieldside. Portable ultrasound is an advanced diagnostic, but is becoming more cost effective and may be a more practical option in the future.

Coagulation: Measuring coagulation in the field is clinically important given the frequent occurrence of rattlesnake bites, heatstroke, and tick borne disease. Although portable devices are marketed for measuring coagulation parameters (PT/PTT), they may be cost prohibitive for occasional use. An effective alternate method is an ACT tube, which were marketed until the mid 2000's as pre-made units but can be easily made using a standard 13x75mm (3-4cc) glass blood collection tube to which is added 12mg (using gram scale) of diatomaceous earth (Sigma product # D5509, CAS#68855-54-9). 2cc of fresh whole blood is collected from the patient and added to the tube directly, capped, then kept in a warm place (typically one's armpit) for 30 seconds. At the 30 second mark and every 10 seconds thereafter, the tube is checked for coagulation and replaced into the warm space between checks. Each clinic should make the tubes exactly the same way every time, and should create their own reference range based on their tube and diatomaceous earth combination.

Another method to measure coagulation is to do a buccal mucosal bleeding time test (BMBT), which may require sedation. In this tableside test, the upper lip is everted upwards and held in place or tied using a gauze muzzle to expose the maxillary mucosa. Using a Surgicutt device, two small stab incisions are made into the mucosa, then filter paper is used to wick blood away from the small cuts (without touching the actual incisions). With normal coagulation, bleeding should stop in under 4 minutes.

Urinalysis: A basic urinalysis is easy to do in the field and can rule out many problems effectively for free. Kidney disease can be effectively ruled out in the majority of cases if there is no urine sediment, no protein on a urine strip, and the urine specific gravity exceeds 1.020 on a refractometer. Diabetes mellitus can be ruled out on the same urine strip if no glucose is present. Ketones, bilirubin, etc. are all present on urine strips and an astute clinician can use this info combined with other tableside tests and a thorough history and physical exam to identify most common problems.

Fecal: Fecal analysis is quick and free for use in field settings where parasites are more common than in residential suburban settings throughout the United States.

Skin scrape: Free, and quick way to look for Sarcoptic mites (scabies) commonly encountered in reservation and Third World settings. The advent of one time oral medications that eliminate Demodex, Sarcoptes, fleas, and ticks with only a simple tablet may preclude skin scraping, but the cost of these meds should be weighed against whatever budget a clinic might be limited to.

Ophthalmologic testing: Shirmer tear strips and fluorescein stain strips are cheap and easily carried for immediate use in field settings for ocular issues, as is an ophthalmoscope and tonometry unit.

Aural: An otoscope is a low cost, portable addition to a medical field kit, given that animals that live outdoors frequently get ticks, foxtails (grass awns), etc. in their ear.

Point-of-care tests: Other rapid tableside tests include Parvovirus rapid antigen tests, Feline Leukemia and FIV tests, IDEXX 4DX tests (Ehrlichia, Anaplasma, Lyme, and Heartworm), and point-of-care coccidioidomycosis tests. These ancillary tests are more expensive than the other (free) tableside tests, but their use in specific cases can provide a rapid diagnosis without the need to send samples to outside laboratories.

Advanced imaging: Finally, although advanced imaging with X-ray and ultrasound was traditionally expensive, high quality digital radiography machines and portable ultrasound units have become significantly cheaper in recent years, and may be financially feasible even for low cost clinics. It is now even possible to use wireless handheld ultrasound probes and view the images on one's phone. Without any cost other than the initial purchase, a skilled practitioner can diagnose a myriad of health issues ranging from fractures to gastrointestinal foreign bodies.

Even without advanced imaging, however, a field practitioner can make a tableside diagnostic kit with a microscope and a tacklebox complete with refractometer, glucometer, slides, slide stain, fecal testing supplies, urine strips, Schirmer tear strips, fluorescein stain, Azostix reagent strips, and a handful of miscellaneous tests (eg. Parvo) for less than $1000 US total set-up cost, and then can diagnose the most common diseases in hundreds of animals, effectively for free. The greatest good, for the greatest number.