

# Zoonoses: drawing the battle lines

ZOONOTIC pathogens are nothing new: some of the earliest forms of parasite possessed zoonotic potential<sup>1</sup> through their "neophilic" status which, as a sound biological strategy, kept their invasive options open – and rightly so.

The inevitable clash of microbial affrontery versus immune integrity in the host-pathogen relationship results in a sometimes uncomfortable balance, with occasional winners and losers on both sides. It almost sounds nice and peaceful – civilised even.

Civilisation, however, is now a major component in facilitating zoonotic disease, as evolved ecological balances that once played out an ongoing tit-for-tat debate over host-pathogen policy become spontaneous acts of terrorism or, worse, all-out biological warfare. Civilised, or "city-ised", society not only breaks old rules of engagement by interrupting hard won truces and interrelated multiorganismal life-cycles, but also offers probing microbes new opportunities and enhanced pathogen status by handing them a rich new and vulnerable resource on a plate – us.

"Modern" humans are a young species of around 200,000 years – a slow blink of an eye certainly pared with usually taking on unfam-

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looks at the easily disturbed balance between microbes and immune responses and advises veterinarians to promote a zoonoses education policy for their clients

miliar microbes with a far more solid history than our own.

Many wild carnivores can feast on putrifying flesh, and even domestic dogs can eat from a rubbish bin, but if we consume slightly mismanaged boiled rice that's been heated at the wrong time then it could result in a trip to A and E for the night. Our immune systems are weak!

Next, we are highly social, so if one of us plays host to an invasive microbe we can provide plenty of chances for furthering pathogenic social climbing. Worse still, we commonly live, work, travel or recreate in considerable biological densities that make it difficult not to introduce microbes to more of us. And if an introduced microbe is of low pathogenic quality to start with, then it certainly has many possible opportunities to elevate its role in morbidity once circulating in the human reservoir systems it – human and immune responses co-exist sustainably. Such a balance can be easily turned on its head.

pean medical or veterinary clinician, but in practice few such diseases can be confidently ruled out on this basis given that the interactive life of humans globally. Information on zoonotic disease, its prevention and management is now widely available.

Not surprisingly, this article could not even scratch the *Bartonella* from the extensive list of known zoonoses – and such a fleeting glance at the subject would be unhelpful anyway. Instead, it may be interesting to look at some under-appreciated aspects of common conditions, as well as emergent infections, that may have an important impact in the future – 75 per cent of emerging

human diseases are zoonotic<sup>3</sup>.

Intentionally, therefore, this article presents an overview of zoonoses and related issues and leaves the reader the option to explore specific diseases in more detail. That said, Table 1 contains a partial "pick and mix" list of zoonoses as a loose guide to what's out there.

Of course, prevalence, or otherwise, of zoonoses is largely related to population geography and lifestyle, making it difficult to pronounce many diseases as generally "common", "uncommon" or "emergent". Also, apparent disease prevalence may not reflect actual prevalence, again greatly limiting epidemiological precision. Accordingly, Table 1

is based largely, and somewhat subjectively, on the author's and colleagues' day-to-day received professional requests.

## Epidemiology matters

Certain foreign and domestic sources may facilitate zoonotic pathogen transmission and these infection hubs include live and dead food markets, pet markets, pet shops, zoos and airports, and infection micro-hubs, such as exotic pets in the home or in work environments such as farmyards<sup>2,3,4</sup>.

Humans and their livestock, and some domesticated pets for that matter, have closely co-existed for thousands of years,

**Table 1. Status of zoonoses**

### Probably common (and often under-undiagnosed)

- Cat scratch fever (bartonellosis)
- Campylobacteriosis
- Cryptosporidiosis
- Lyme disease (borreliosis)
- Pigeon fanciers' disease (allergic alveolitis)
- Psittacosis (chlamydiosis)
- Reptile-related salmonellosis
- Ringworm (tinea microsporum)
- Salmonellosis
- Toxoplasmosis

### Probably uncommon

- Babesiosis
- Brucellosis
- Hydatid disease (echinococcus)
- Leptospirosis
- Rabies (rhabdovirus)

### Emergent

- Avian influenza (HPAI H5N1)
- Equine encephalitis (togavirus)
- Hantavirus pulmonary syndrome (hantavirus)
- Monkeypox virus (variola)
- Rift Valley fever (bunyavirus)
- SARS (severe acute respiratory syndrome)
- West Nile virus (flavivirus)

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Asking whether a patient has really visited a farm, for example, during a school trip (above) is now one of the questions doctors have to ask to try to identify possible zoonotic causes of illness.

safeguard against remotely-acquired infection.

At least travellers have their eyes partially open to disease avoidance. Purchasers of exotic animals from an apparently innocuous high street pet shop – or worse from an aberrant pet market – are likely unaware of the potential "Trojan horse" of infection each bird, fish or snake may represent.

Endotherms procedurally undergo 30 days compulsory quarantine, designed to identify rabies and exotic Newcastle disease. This system, however, is now popularly known to be flawed with both mechanical and policy failures. Ectotherms, despite harbouring a vast array of human and agricultural pathogens from cryptosporidiasis to heartwater disease, undergo no quarantine.

Air transport, therefore,

has the very viable capacity to carry people to disease and disease to people in an airborne super-expressway for microbes. Zoonotic infection or infestation troubles may quite literally be "in the air" with any flight.

Humans are increasingly encroaching on remote ecosystems, or bringing them piecemeal into their homes<sup>3</sup>. In short, mixing humans with novel wildlife and wildlife products on a daily basis is speed dating for bugs and evidence-based bio(in)security gone mad!

And how easily are zoonoses spotted and tracked? They aren't. An average GP might not consider zoonoses particularly common. But how would they know, when it has been shown that medical practitioners don't ask searching questions of patients with zoonoses-ambiguous signs<sup>5</sup>? A patient presenting

**Table 2. Standard questions to ascertain source of infection**

- ? Recently consumed foods (and their condition).
- ? Visits to restaurants.
- ? Foreign travel undertaken\*.
- ? Visits to hospital\*.
- ? Visits to farms\*.
- ? Visits to zoos and other wildlife centres\*.
- ? Visits to pet shops\*.
- ? Whether the patient household possesses any pets.
- ? Whether the patient has visited a household that possesses pets.
- ? Whether (and in particular in the categories marked with an asterisk above), the patient or others in the household may have had direct or indirect contact with persons or inanimate material from these categories.

From: Warwick (2004).

yet even here diseases such as salmonellosis, cryptosporidiasis, campylobacteriosis, babesiosis, rabies, tuberculosis and brucellosis are still not genuinely describable as resident multi-host diseases as they are often

spontaneous, not self-limiting and require radical intervention controls, among other things.

Travellers frequently appreciate the prudence of prophylactic measures before going abroad, although this is not a certain

with respiratory symptoms may have psittacosis from a pet parrot and a patient presenting with gastrointestinal symptoms may have salmonellosis from a pet lizard. Because these common zoonoses respond to general medical management, GPs make little or no effort to source-trace or contact-trace and, therefore, illness cause and a potential epidemic may go unchecked too long<sup>5</sup>.

Accordingly, a table of questions was published for doctors to follow that may aid in identifying possibly zoonotic causes (Table 2) and veterinarians might ask some of these questions in indicated cases and consider referral with advice to the client's GP<sup>5</sup>.

With the assessment of risk and the diagnoses of zoonotic disease unclear for medical and veterinary practitioners, where does this leave local authorities that must ascertain the possible public health issues of potentially thousands of exotic pathogens that may reside under the skin of snakes or be waiting in the wings of birds? Each animal class represents hundreds of species globally, most of which are wild-caught.

**Hygiene and transmission**

All too often the "cautious advice" passed along by doctors and vets to prevent acquiring zoonoses from direct contact revolves around good old hand-washing, as if it were some panacea, literally in the palms of one's hands.

Any microbiologist knows how casually transferable biological detritus and microbes can be and that a route to recontamination of cleaned hands (presumably cleaned to surgical standards) is a simple matter of contact with an array of intermediary surfaces available by reaching into a previously probed pocket or touched tie. It may also be more than a little optimistic to presume that anyone would follow even this meagre "hand-washing" advice, given that healthcare professionals are notoriously bad at it themselves<sup>6</sup>.

**A few suggestions...**

With the mixing and mismatching of humans and novel pathogens already in progress and

looking increasingly worrying, something preventive has to be done – and promptly – because epidemiological and economical catastrophes from cumulative or pandemic zoonoses are out there, and with our name on them. Addressing the global movement of humans into novel environments, as well as the introduction of exotic animals into novel environments, are two broad-effect primary measures that may be fundamental to prevention and control of zoonoses.

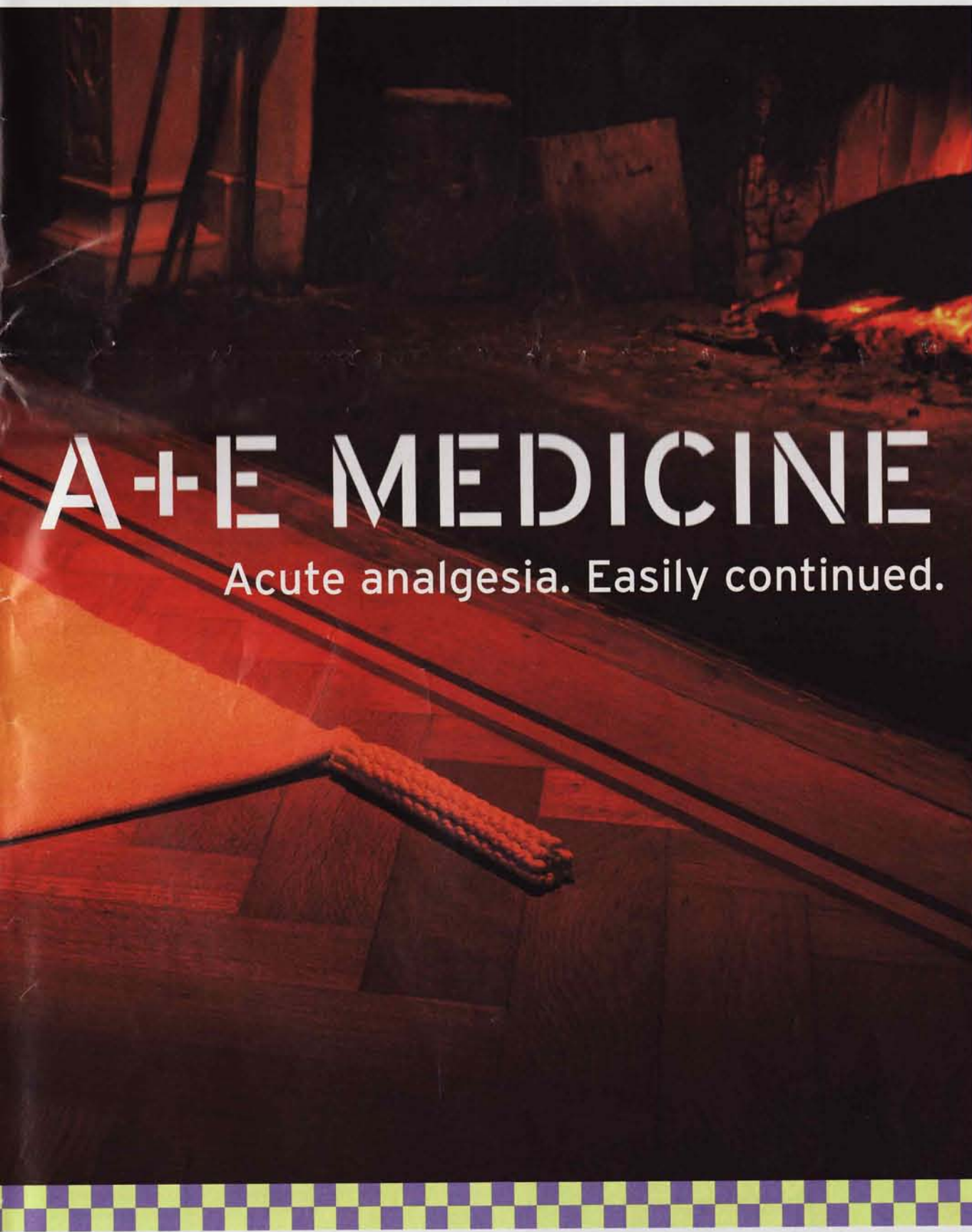
Restricting global travel is clearly a highly-sensitive, controversial, extreme and, likely, under-supported measure. Commercial consequences for airlines as a result of imposed restricted travel could be serious – but such a restriction may be inevitable. Perhaps avoidance of broad travel restrictions might be aided by routine screening of voluntary subjects such as regular visitors to remote regions and some airline cabin staff – both of which could possibly act as an early warning system for migrating pathogens. No doubt this is a rather inconveniencing suggestion to some, but to voluntary "screenees" incentives could be offered, and for airlines it could by far be the lesser of two evils.

A far less controversial and more easily applied measure to protect against the transmission of many common and emergent zoonoses is the increasingly popular proposal of a permanent global ban on the movement and importation of wild-caught animals for the pet trade.

The occasional suggestions that this plan would lead to increased smuggling are hyped and largely artificial.

Vets in general practice are well located to advise and, if necessary, caution their clients on zoonoses. In the author's experience few vets actively educate the public and most, if not all, could do more. A zoonoses education policy is not scaremongering, but responsible and relevant professional guidance that should go beyond merely recommending "hand-washing" to include (especially where exotic pets are involved) enhanced hygiene, such as the use of disposable garment pro-

*continued overleaf*



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arm, and sent me off into the Rocky Horror Show. The carpet was unpleasantly sticky, and static sparked off my feet as I waded through the deep red nylon shag pile. After a flight of stairs, I made it to reception, or the equivalent in sauna jargon.

I parked the van and locked it. Then I made sure all the buttons on my consulting jacket were firmly done up, all the way to my chin. The practice logo was emblazoned across my left clavicle. My long hair, normally in a pony tail, was tied up in a severe bun. My baggy jeans

A girl, who hardly looked to have seen her twenties, was

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tectors, particularly in families with vulnerable groups.

It is well worth reminding oneself that healthy animal patients (again, especially exotic forms) may harbour a raft of zoonotic microbes, let alone those animals that are presented as sick patients and manifest exaggerated microbial shedding. Good animal welfare is likely an important feature in decreasing zoonotic infection risks.

Zoonoses awareness is increasing, but so too is the mixing of humans with other species and their environments. We are chasing our tails.

Clinical and public knowledge deficits, along with practical complacency, offer a virtual welcoming committee to zoonotic threats. Difficulties of disease prevention, identification and treatment are exacerbated by the absence of a unified strict government policy of zoonoses prevention and control.

The government's recent poor hand-ling of avian influenza, related quarantine issues and its curious attempts to introduce exotic bird and other wildlife

markets to the UK demonstrate a lack of evidence-based decision and policy-making that warrants urgent and radical re-evaluation.

Some zoonotic infections we can see coming. Others may take us completely by surprise. The least sensible thing to do is to simply sit back and wait!

### Background reading

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