# Veterinary urban hygiene: a challenge for India

This paper (No. 20112013-00016-EN) has been peer-reviewed, accepted, edited, and corrected by the authors. It has no yet been formatted for printing. It will be published in December 2013 in issue 32 (3) of the *Scientific and Technical Review.*

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**Summary**

India is confronted with many hygiene problems in urban areas that are related to animal populations. While some of these issues have been present for many years, others are only now emerging. A livestock census in 2003 and another in 2007 revealed that populations of crossbred cattle, goats and poultry are all increasing in urban areas, since this enables easy market access, which, in turn, reduces transportation costs and adds to profits. The canine population has increased along with the human population, largely due to a lack of control measures such as impounding stray animals and euthanasia.

These increases in populations of both food-producing animals and stray animals in cities exacerbate such public health hazards as the transmission of zoonoses, vector-borne diseases, occcupational health hazards and environmental pollution, as well as compromising animal welfare. At present, public health hazards due to urban animal husbandry practices are considerably under-estimated. To improve veterinary-related urban hygiene and to facilitate livestock production operations in urban areas, there is an urgent need to develop sound, science-based strategies enforced through stringent regulations. The use of One Health teams may provide an answer to these highly integrated public health problems.

**Keywords**

India – One Health – Urban hygiene – Veterinary urban hygiene.

## Introduction

The concept of veterinary urban hygiene deals with aspects of public and animal health associated with the interface between humans, animals and the environment in urban areas (1). Although dairying operations take place in urban areas in nearly all developing countries, they are particularly important in South Asia, especially in India and Pakistan (2). India is one of the most densely populated countries in the world and continues to undergo rapid urbanisation, mostly unorganised and haphazard (3).

According to the 2001 census, the total urban areas of India (5,134 cities/towns) make up approximately 2.34% (77,370.50 km²) of the total area of the country, with an average area of 15.07 km² per city/town. The density of cities/towns was in the range of 41 to 104,267 people per km², with an average density of 3,675 people per km² (4). In India, the principal farming operations in urban centres are cattle and buffalo farming for milk, and poultry and pig farming for meat. Urban dairying is practised in most cities in India, both small and large (2), as this enables easy access to markets, lower transportation costs (5, 6), and higher returns on animal production (7). Other factors driving the increase in urban dairying in India are

related to food security and an increased demand for nutritious food among the growing middle classes in the cities (8). Urban husbandry has the potential to provide new employment opportunities, increase export potential, bridge the gap between supply and demand in livestock production and ultimately to make a valuable contribution towards the country's gross domestic product. However, the increase in urban animal operations has also demonstrated the increasing importance of urban hygiene, one of the branches of the veterinary sciences (9). Veterinary urban health is a multidisciplinary science, encompassing all sectors involved in urban policy and management that are related to animal husbandry operations (10, 11). The situation in India is further complicated by the presence of large numbers of stray animals and disease vectors (mosquitoes and flies), in addition to companion and food-producing animals. Therefore, veterinary urban health needs strong holistic and epidemiological support because of the regular emergence of zoonoses and other animal-related health and occupational issues (12). Although significant effort has been devoted to studying the relationships between agriculture and zoonotic diseases in general, the same has not been done for urban animal-production operations (13). While many studies have been commissioned by various international bodies in developing countries, including India (14), a comprehensive review of urban animal health in India has not yet been undertaken. This gap provided the impetus for the present review, which focuses on the current veterinary urban health situation in India, its related risks and its growing importance.

## Current scenario

### Livestock, poultry and dog populations

A significant portion of the global livestock population is actually found in India (Table I). There is scarce information (15) on urban animal husbandry practices in India. Trends in animal population growth between the 2003 livestock census and that of 2007 revealed an increase in the numbers of crossbred cattle, goats and poultry in urban areas. There has been a simultaneous decline in the number of less productive livestock such as indigenous cattle in the urban areas

of India. This growth in specific food-producing animal species may be due to increased demand as a result of the increased purchasing power of the urban middle class, easier access to the market and an effort to reduce transportation costs. A survey among 891 peri-urban cattle-owners in Pondicherry showed that the majority owned from one to three cattle and that dairying contributed 45% of the gross family income (16, 17). Another study estimated one dairy cow for every ten citizens and ten to 20 cows per dairy operation in urban areas of India (18). Ludhiana, a major city in northern India, has more than 500 dairy farms, each with between ten and 100 animals. In addition, pig farming is very common in urban cities in North-East India, particularly in the state of Mizoram (15), and is also practised in other urban areas by people in lower socio-economic strata. Poultry-farming is one of the fastest-growing animal industries in India and is largely concentrated around urban centres (19). There has also been an increase in the numbers of sheep and goats in urban areas such as Ahmdabad, in Gujarat State (15).

The traditional use of camels, horses and other equines for draught power has become virtually obsolete with the availability of modern transport systems in urban India, which may be the reason for the dwindling populations of these species. Other livestock species, including yaks and mithun cattle, are confined to selected pockets of India and do not mirror the overall trend in urban livestock population growth (Table I).

## The stray animal population

In India, approximately 2,575,000 dogs live in urban areas, out of an estimated total population of 19,087,000 dogs throughout the country (20). There has also been a rise in canine populations in Indian cities (Table I), as more middle-class urban families decide to keep dogs as pets (21), and also due to the adoption of the Animal Birth Control Programme as an alternative to impounding dogs and euthanasia. The stray dog population was controlled by impounding and euthanasia until 1998, but this has been replaced by a policy of animal birth control, due to pressure from animal welfare activists (22, 23, 24).

Rigorous desexing programmes need to be deployed at animal welfare shelters and in public veterinary clinics to check the ever-increasing population of stray dogs (25).

Most Hindu Indians consider cows to be holy. Therefore, their slaughter is banned in most Indian states, resulting in a huge population of stray cattle. Despite the unavailability of national data on the stray cattle population, estimates conclude that the capital city of New Delhi alone is home to more than 20,000 stray cows (26). Stray cattle are usually older cattle that have reached the end of their productive lives and are turned out onto the streets by their owners. Cow sanctuaries (*Gaushala*) play a very important role in the management of stray cattle in India, as they provide shelter for hundreds of cattle. But the exact number of cow sanctuaries in India is not known. The National Commission on Cattle conducted a preliminary survey in 2002 and concluded that cow sanctuaries are present in significant numbers (27). Still, their capacity is not sufficient to cope with the population of stray cattle (although they do help to curtail the problem). There is, however, a pressing need for the municipal, state and federal governments to develop new facilities to fence in stray cattle and establish guidelines that prevent cow sanctuaries from letting their animals breed.

Although the stray pig population in cities has not been documented, a number of studies have been carried out on the risks associated with stray pigs in urban areas (17, 21). Interestingly, this population is slightly different from other animal populations in that the pigs are left to range freely and are caught and slaughtered by their owners at maturity or when needed. Incidentally, there is little potential for stray sheep and/or goat populations, due to their easy marketability and the high demand for sheep and goat meat.

## Rodents and vector populations

Rodents (28, 29, 30), vectors (mosquitoes, ticks, flies, bugs, etc.) (31, 32, 33, 34, 35) and other pests are important animal species that also have a considerable impact on veterinary urban health activities.

They have a major role as disease vectors and thus play an important part in the transmission of zoonoses.

### Birds and other synanthropic animals

There are other important species, such as birds (36), residing in urban areas but their role in relation to veterinary urban health has seldom been questioned or discussed in India. The role of bird faeces as a contaminant should be examined when assessing the quality of water from various sources, such as lakes, rivers and wells, especially when these sources are used to provide drinking water. Birds are also an important vector or reservoir of many pathogens. Pet or stray domestic cats (37) and monkeys (38) are also common in urban areas.

### Fisheries

Fisheries are quite popular in Indian coastal cities, e.g. in Kolkata (formerly Calcutta), West Bengal (15, 39, 40). Contrary to other husbandry practices, wastewater aquaculture, as practised in the East Kolkata Wetlands, has attracted much international attention as a model system for the re-use of urban wastewater and resource recovery (40), leading to improvements in urban hygiene. Fish and related species may not contaminate the urban environment, but the role of unofficial fish markets in urban areas should attract the attention of policy-makers. In addition, poorly managed fish ponds may become breeding grounds for many water-related vectors, such as flies and mosquitoes (41).

## Related risks

Livestock spread many microorganisms through their faeces and many of these microbes have zoonotic potential and can infect humans through the ingestion of contaminated water and food (42, 43). The risks of disease outbreaks from contaminated water and food are immensely increased in densely crowded urban environments, especially those without adequate sanitation (44). The other problem is that health hazards due to urban livestock operations in India are considerably under-estimated. However, it is generally accepted that

there has been an increase in zoonoses, vector-borne diseases and diseases associated with the re-use of urban wastes and wastewater in urban areas (41). Lastly, the presence of stray animals, their faeces and urine, and the smell emanating from fallen carcasses create a public nuisance and other environmental problems (45).

## Zoonoses

Livestock operations in urban areas create a major public health concern because of the risk of zoonoses (46). About 20,000 human deaths are reported every year from rabies. Most of these are due to bites from rabid dogs (47), of which about 60% are strays and 40% are owned pets (22). Free-roaming dog populations have emerged as both animal welfare and public health concerns in developing countries (48). Free-roaming dogs account for 99% of cases of rabies transmission worldwide (49) and have also been incriminated in more than 60 other zoonotic diseases (48). In India, there are an estimated 2.49 deaths/100,000 people in rural areas, compared with 0.37 deaths/100,000 people in urban areas, due to rabies (48).

Of late, animal protection organisations have launched a crusade for capture, neuter and return (CNR) programmes to curtail canine population growth and to improve dog welfare. This offers a sustainable remedy for both the disease and animal welfare problems posed by free-roaming dogs in developing countries (48). Animal birth control programmes in India were launched in response to public concerns over the use of strychnine poisoning and electrocution as the dominant animal-control strategies (48). In 1992, New Delhi's High Court decided that animal birth control programmes should replace other cruel and ineffective methods of dog control, such as strychnine poisoning (48). A pilot programme by Help in Suffering in 1994 and 1995 demonstrated the effectiveness of CNR in several areas of Jaipur. The programme was then expanded to all of Jaipur. The Jaipur programme has developed new techniques for counting street dogs and for the capture and return of such dogs (48). Animal birth control programmes have now been initiated in Mumbai (formerly Bombay), Delhi, Kolkata, Chennai (formerly Madras), Bangalore, Hyderabad,

Udaipur and Jodhpur. However, the success of animal birth control programmes hinges on being able to sterilise 70% of the stray dogs in a given geographic area within six months, before the next reproductive cycle begins (22). This target seems an uphill task because of the large number of stray dogs and the limited resources to undertake mass sterilisation programmes (22).

The presence of dog faeces in open spaces and public pathways, because of strays or the bad habits of owners who do not remove them, are an important source of zoonotic pathogens, as well as causing deterioration in the public environment (50, 51). Many parasitic zoonotic diseases have been reported as being prevalent in pigs in urban areas (52, 53, 54). Many bacterial zoonotic diseases, such as brucellosis (55), leptospirosis (56) and bovine tuberculosis (57), are also prevalent in urban areas in India (58). Pigs are believed to be an important carrier of hepatitis E viral infections (34). Sorbitol-fermenting enterohaemorrhagic *E. coli* O157 has been isolated from the Ganges River, probably as a result of contamination from animal faeces (59). Shiga toxin-producing *E. coli*, a potential contaminant of water and food (60), has been isolated from cattle in Kolkata. Pigs are typically found near poultry farms in densely populated urban centres; consequently, people living in those areas are at greater risk of contracting highly pathogenic diseases, such as influenza (61). Wet markets in urban areas may also serve as a potential source of avian influenza infection for live bird handlers (62). Furthermore, many respiratory pathogens, including influenza, are also influenced by population density and husbandry practices, such as indoor pens and overcrowding (62).

## Occupational health hazards

Urban animal husbandry practices, especially in congested areas, may pose occupational health hazards for workers in dairy and other related industries (41, 63, 64, 65, 66). Typical examples include the risk of occupational brucellosis caused by rearing livestock in unhygienic conditions and the movement of pathogens through the uncontrolled movement of livestock (46, 59).

## Vector-borne diseases

Faeces, urine and other animal wastes cause air pollution through bad odours and serve as breeding grounds for many vectors (44, 45). In recent years, vector-borne diseases have emerged as a serious public health concern in countries of the South-East Asian region, including India (33, 35). Many of these, particularly dengue fever and Japanese encephalitis, now occur in epidemic form almost annually, causing considerable morbidity and mortality (34). Chikungunya (67), leishmaniosis (54), West Nile fever (68) and Crimean-Congo haemorrhagic fever (69) are the other vector-borne zoonoses that have been reported from urban areas of India. Unplanned and uncontrolled urbanisation is one of the contributing factors which play a key role in the spread and transmission of dengue fever (34). An explosive epidemic of suspected primary pneumonic plague was reported in the city of Surat in Gujarat State in India in 1994 (70). Rodent and vector-borne diseases in urban parts of the country have shown a rapid growth, due to the co-habitation of their hosts in areas around animal populations where proper sanitation is not maintained.

## Environmental pollution

### Illegal slaughter and other related practices

Illegal slaughter and other related practices are important issues, which need urgent attention in urban areas (71). As a result of frequent illegal slaughter practices, there is a constant risk of inferior-quality meat being supplied to consumers. Illegal slaughter practices near cities include butchering animal carcasses in open areas to remove their skin, bones or other tissues for use in the leather and animal-feed industries. These practices may result in an increased risk of zoonoses, occupational health hazards and environmental pollution, due to a lack of proper carcass waste disposal. Diseases that have been reported due to illegal slaughter in urban areas of India are listed in Table II (72, 73, 74, 75, 76, 77, 78, 79). There are many other diseases, such as tuberculosis, listeriosis and brucellosis, which are believed to occur as a result of the illegal slaughter and improper disposal of animal carcasses. Most of the time, animal waste is left to

rot in the open, becoming a source of protein for stray dogs, thus encouraging the stray dog population. Sometimes, animal waste is simply dumped into the domestic sewage disposal system, leading to the contamination of sewage, which is often used to irrigate agricultural fields (80). To halt the risks arising from these activities, local municipal bodies must curb the practice of illegal slaughter in urban areas (80). Eco-friendly methods of disposing of or re-using animal wastes safely, for instance to produce bone meal, must be found and carried out in a well-regulated and controlled manner.

As reported by the Ministry of Food Processing in 1989, there are a total of 3,616 officially recognised slaughterhouses in India, in which over two million cattle and buffalo, 50 million sheep and goats, 1.5 million pigs and 150 million poultry are slaughtered annually for domestic consumption, as well as for export purposes (80). Most of these slaughterhouses are more than 50 years old and are without basic amenities, such as proper flooring, ventilation, a water supply, lairage or transport. Furthermore, most slaughterhouses have very low hygiene standards, causing a major public health hazard for workers, as well as environmental hazards, due to the unsanitary disposal of wastes and discharge of highly polluted effluents. Unauthorised and illicit slaughtering has also increased considerably in recent times, triggering the resulting problems of unsafe food on the market, occupational health hazards and environmental pollution (80). Thus, there is an urgent need to modernise existing abattoirs and establish plants for using the remainder of animal carcasses throughout the country.

## Animal waste disposal

Faeces from stray pigs contain parasitic eggs, which can contaminate food and water (21). The huge problem of poultry waste may result in serious water and soil pollution (19). Owing to the increase in the dog population in urban areas, including both stray and companion animals, many more faeces are found in public places, leading to environmental pollution (51). Toxocariasis, ascariasis and echinococcosis/hydatidosis are the most important parasitic zoonotic

diseases that occur as a result of the environmental contamination of soil, food and water by infected dog faeces (54, 72). Several studies have demonstrated the transition of echinococcosis from a primarily rural disease to an urban infection, which may largely be due to an increase in livestock operations in urban areas (46, 81). In a recent study carried out in Nagpur, faeces from roaming pigs were found to be the cause of soil contamination with gastrointestinal parasites (21).

## Use of agrochemicals

As a result of congestion and production stress in so-called 'factory farms' in urban areas, livestock diseases are more likely to occur and spread quickly. Consequently, more agrochemicals, particularly antibiotics and growth promoters, are being used on animals on these farms (2). The highest incidence of bovine tuberculosis is generally observed where dairy production is most intensive, notably in the milk sheds of the larger cities (82). Under intensive feedlot conditions, a death rate of 60% and depressed growth have been found in tuberculosis-infected zebu cattle (83). The use of agrochemicals in urban animal husbandry practices poses other public health risks, as these harmful chemicals are more likely to enter the food chain. Vulture populations in India and Pakistan have decreased dramatically, due to the use of the common, non-steroidal, anti-inflammatory drug diclofenac in livestock (84). When these animals' bodies are dumped, the vultures feed on them and are poisoned. Dogs have replaced vultures as the main scavengers at carcass dumps, and so it is reasonable to assume that the increase in the dog population has partially resulted from the decline in the vulture population (85). This is likely to result in an increase in dog bites and, as a consequence, more rabies cases in humans (85). The potential impact on human health of an increase in rabies associated with the decline in the vulture population has been found to be significant (85). Scientific management of garbage and wastes from slaughterhouses is sorely needed to manage these highly interconnected problems of animal and human health in urban centres.

## Food safety

Urban food animal practices result in an increase of unofficial fish, meat and milk markets in cities, where raw produce is sold directly to consumers. These markets increase the likelihood of food contamination and disease outbreaks (86). High stocking densities and overcrowding in intensive food production operations result in animal welfare issues (87) and increase the risk of poor quality food (13, 88).

## Accidents and animal nuisance

Stray animals in public places create a nuisance to the general public, due to bites, smells and noise (89). Stray cattle are a major cause of road accidents in cities (90). In a study conducted in Hyderabad, collisions of two-wheelers (scooters and motorcycles) with stray animals were responsible for 2.5% of total hospitalisations due to road accidents (91). It was suggested that the sudden application of brakes (due to the appearance of a vehicle/person/animal in the road) resulted in a fall due to loss of balance, which was responsible for the majority of road-related accidents in cities in India (92), as these roads are used by modern vehicles as well as animal carts (93). In Delhi, of those road users killed in accidents, 3% were humans driving animal-powered vehicles (93). Another study in Pondicherry showed that 5.6% of injuries to pedestrians are caused by bullock carts (94). The incidence of animal bites is also high in cities in India. For example, the incidence of animal bites in New Delhi causes minor injuries to 2.5 out of every 1,000 people and major injuries to 5.3 out of 1,000, with an overall rate of bite injuries of approximately 8 out of every 1,000 people every year (95).

## Animal welfare and ethical issues

The animals themselves suffer because of urban livestock operations, as a result of poor livestock facilities and hygiene practices, insufficient space thanks to confinement in high-density conditions, poor ventilation, neglect and poor care of male calves in urban dairies (66). Although there are many government-assisted cattle sanctuaries (96), and aid from non-governmental organisations, such as People for

the Ethical Treatment of Animals (PETA) (97), they do not have sufficient capacity or resources to take care of all the needy animals. The European Parliament recently adopted a proposal advocating higher welfare standards for chickens raised for meat, including a provision that would regulate or prohibit imports of chickens not raised with a similarly high standard of animal welfare. The reality is that each country wishing to export poultry must comply with these stricter animal welfare standards and India must also implement these standards and ensure strict compliance if it wants to export into Europe and, no doubt, into other countries which may also adopt such measures in the future.

## Conclusions

It is clear that, because of urbanisation and an increased demand for animal-based food products in the cities, the rise in livestock operations in cities and on their peripheries will continue. Thus, there is a clear need to develop and apply the scientific practices of veterinary urban health in India. The establishment of new animal production enterprises in and around India's cities must be tightly regulated and carefully managed to minimise the various risks of contaminated food and water, disease outbreaks and animal abuse. In addition to legislation and enforcement, farmers and consumers should be educated in improved veterinary urban hygiene practices. The decline in the vulture population because of the open-air disposal of cattle carcasses with residues of diclofenac in their tissues is just one example of the inter-relatedness of all these systems.

The scenario outlined above cannot be managed through previously used, single-discipline solutions. The problems of urban livestock operations are tied into rapid urbanisation, the increasing demand for animal protein by the urbanised middle classes, overcrowding, and increased proximity between animals and humans. Overcrowding in the cities also has a serious adverse impact on the environment. The fact that problems related to urban livestock operations are so closely integrated with issues of human and environmental health calls for the use of the One Health principles to manage and solve these complex

problems (98). The One Health approach requires close collaboration among specialists from all the sectors of human, animal and environmental health (99).

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**Table I**

**Total numbers of livestock, poultry and dogs in urban India**

(in thousands)

Population numbers have been approximated in thousands. Annual growth rates have been calculated from the exact figures

| Species | Livestock population 2003 | | Livestock population 2007 | | Annual growth rate % (2003–2007) | |
|---|---|---|---|---|---|---|
| | Urban[a] | Total | Urban | Total | Urban | Total |
| Cattle | 9,530 | 185,181 | 8,778 | 199,075 | –2.04 | +1.83 |
| Indigenous | 6,780 | 160,495 | 5,670 | 166,015 | –4.37 | +0.85 |
| Crossbred | 2,750 | 24,686 | 3,107 | 33,060 | 3.10 | +7.58 |
| Buffalo | 5,993 | 97,922 | 5,427 | 105,343 | –2.45 | +1.84 |
| Sheep | 3,478 | 61,469 | 1,957 | 71,558 | –13.39 | +3.87 |
| Goats | 6,878 | 124,358 | 7,224 | 140,537 | 1.23 | +3.10 |
| Pigs | 2,108 | 13,519 | 1,174 | 11,134 | –13.62 | –4.74 |
| Horses and ponies | 71 | 751 | 55 | 611 | –6.14 | –5.01 |
| Mules | 20 | 176 | 12 | 137 | –12.21 | –6.05 |
| Donkeys | 107 | 650 | 66 | 438 | –11.49 | –9.00 |
| Mithun | 31 | 278 | 31 | 264 | –0.40 | –1.25 |
| Total livestock[b] | 28,233 | 485,002 | 24,733 | 529,698 | –3.26 | +2.23 |
| Dogs | 1,989 | 16,719 | 2,575 | 19,087 | 6.67 | +3.37 |
| Poultry | 39,873 | 489,012 | 42,092 | 648,830 | 1.36 | +7.33 |

a) Municipalities, corporations, cantonments and notified town areas

b) Total livestock: bovines (cattle, buffalo, yaks and mithun), sheep, goats, horses, ponies, mules, donkeys, camels and pigs

*Source*: Basic animal husbandry statistics 2010, Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture, Government of India (20)

**Table II**
**Diseases that occur due to illegal slaughter in various parts of India**

| Disease | Host | City | State | Reference |
|---|---|---|---|---|
| Cysticercosis (*Taenia solium)* | Pigs | Ludhiana | Punjab | 52 |
| Echinococcosis *(Echinococcus granulosus)* | Pigs, sheep. goats | Ludhiana | Punjab | 72 |
| Sarcocystosis *(Sarcocystis suihominis)* | Pigs | Ludhiana | Punjab | 73 |
| *Salmonella* species infections | Goats | Barielly | Uttar Pradesh | 74 |
| *Salmonella* species infections | Fish and crustaceans | Coimbatore | South India | 75 |
| Unsafe coliform bacterial infections | Pigs | Urban areas | Nagaland | 76 |
| Anthrax (*Bacillus anthracis)* | Dead goats | Reported from rural areas but similar practices can also pose an important risk in urban areas | Andhra Pradesh | 77 |
| | Dead bullocks | | West Bengal | 78 |
| | Cattle | | West Bengal | 79 |