Biological warfare and the people of Iraq

From IAN ROBERTS

Sirs—The only property of micro-organisms that enables them to be used as biological weapons is their capacity to cause infectious disease. People may be deliberately exposed to pathogenic micro-organisms in a variety of ways but it is the fact of exposure rather than the method of delivery that determines whether disease will result. Because the ability to cause infection is the defining aspect of a biological weapon, then any malevolent intervention that causes infection in the civilian population constitutes an attack with a biological weapon.

Micro-organisms are necessary but not sufficient in the causation of infectious disease and other causal factors are required for infection to occur.1 Host resistance is an important factor in the chain of causation leading to clinical infection.2 Whether or not exposure to a micro-organism causes disease depends on whether or not the exposed individual is susceptible or immune. Dietary deficiency of key vitamins and micro-nutrients increases susceptibility to a number of infectious agents and also increases the likelihood that infectious disease will result in severe illness and death. Vitamin A and zinc deficiency impair the ability of the immune system to fight infection and the ability of mucous membranes to resist infection.2,3 Indeed, the decline in infectious diseases in high-income countries is more readily attributed to increased host resistance from better nutrition than to a reduction in the virulence of the relevant micro-organisms. It follows that any malevolent intervention that impairs the ability of a civilian population to resist infection constitutes biological warfare.

In public health practice, prevention involves removing one or more of the components in the chain of causation leading to disease. From an epidemiological perspective, causation and prevention are two sides of the same coin.1 For this reason, a consideration of the actions that can prevent infectious disease from occurring after exposure to a biological agent can help to identify the other components in the causal chain. For example, following an attack with anthrax, spores can be washed off with soap and water and oral antibiotics can be given to prevent infection from developing.4 If an anthrax attack occurred in situations where antibiotics were unavailable then some cases of anthrax infection would be attributable to their absence. Consequently, any malevolent intervention that destroys a population’s ability to respond effectively to infectious diseases constitutes a biological attack.

These rather mundane scientific considerations have important implications for how biological warfare is defined in the context of the current conflict in Iraq. First, it implies that the Anglo-American bombing of water supplies, sanitation plants, and the power plants that are necessary for their functioning, constitutes a biological attack. Standard texts on biological weapons point out that three factors must be taken into account in selecting a biological agent for a biological attack: ease of manufacture, stability, and lethality. Despite widespread public concern about the use of anthrax, smallpox, and plague, all three are difficult to manufacture and disseminate. Anthrax requires sophisticated methods of manufacture and virulent stock is hard to find. The only confirmed sources of smallpox are in the US and Russia, and plague is both difficult to obtain and difficult to weaponize.5 On the other hand, the microbial agents that can cause devastating epidemics of diarrhoea are ubiquitous, lethal, and are readily disseminated by destroying the civilian sanitation infrastructure by bombing or otherwise destroying water sanitation and sewage disposal systems. These actions will ensure that food and water supplies to the civilian population will quickly become contaminated. Because the faeces of infected people will further contaminate the water supply and because there will be extensive person-to-person transmission this strategy has the potential to result in extensive, population-wide, and self-propagating epidemics. The scope for civilian casualties with such an approach is massive in comparison with the use of agents such as anthrax for which there is no evidence of person-to-person transmission. Declassified documents from the American Defense Intelligence Agency show that during the 1991 Gulf War, the ‘Allies’ deliberately targeted Iraq’s water supply. Twelve years later, half the water treatment plants are still out of action.5

Second, the economic sanctions imposed by the United Nations Security Council that have caused widespread dietary deficiencies throughout the civilian population, seriously reducing the ability of the population to resist infection, constitute a form of biological warfare. Micro-organisms that pose little threat to those with intact immune systems can be highly lethal to those with impaired immunity as a result of micronutrient deficiency and malnutrition. For example, life-threatening diarrhoea can be caused by ubiquitous microbes such as Escherichia coli that reside in the gastrointestinal tract and common respiratory viruses can cause highly lethal pneumonia. As a result of the sanctions against Iraq there has been a more than doubling of the infant and under-5 mortality rates, with most of the excess child deaths being due to diarrhoea and pneumonia exacerbated by malnutrition.6 The imposition of economic sanctions in Iraq is as much a form of biological attack as was the distribution of anthrax in the US mail system.

Third, the destruction of the Iraqi population’s ability to respond to outbreaks of infectious disease by restricting the import of essential medicines and medical equipment, by destroying the public health infrastructure, and by overwhelming the capacity of the healthcare system to respond effectively constitutes a further biological attack.

Fourth, having destroyed Iraq’s water and sanitation systems, leaving the civilian population highly vulnerable to major epidemics of infectious disease, the failure to restore the public health infrastructure and provide safe water supplies to homes and hospitals constitutes a biological attack. In this context, recent reports that reconstruction contracts may be awarded to the US company Bechtel are a particular cause for concern. In 1999, a Bechtel subsidiary took over the control of the public water system in Cochabamba in Bolivia and within weeks doubled and tripled the water rates for some of the poorest families in South America resulting in massive public
demonstrations.\(^7\) Also, we must not forget that in the case of Afghanistan, despite the Bush administration’s claim that ‘the US will not walk away from the Afghan people’, the administration subsequently forgot to ask for any money for humanitarian and reconstruction costs in its 2003 budget.

The full extent of civilian casualties resulting from the war on Iraq will become clear in the coming weeks and months. An effective humanitarian response must be mounted urgently to reduce the death toll from this appalling episode in the history of biological warfare.

**References**


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**Global trends in adenocarcinomas and obesity: an epidemiologic link?**

**From ZUBAIR KABIR and LUKE CLANCY**

Sirs—Recent studies on cancers of lung,\(^1\) oesophagus,\(^2\) gastric cardia,\(^3\) kidney,\(^4\) prostate,\(^5\) breast,\(^6\) colon,\(^7\) gall bladder,\(^8\) uterine cervix,\(^9\) and endometrium\(^10\) show an increasing trend in a particular histological sub-type, namely, adenocarcinoma, especially among the relatively young cohorts. The biological implication of this distinct epidemiological and potentially aetiological entity is poorly understood. Long-term trends in cancer incidence do provide significant leads to an underlying causal pathway. However, trends of major cancer sites by histological sub-types have received little attention. Such trends may identify the possible role of any putative risk factors, which may not be apparent in studies looking at the overall cancer trends. For instance, despite a downturn in overall lung cancer incidence, younger females are experiencing a relatively steep increase in lung adenocarcinoma incidence, while the remaining histological sub-types of lung cancer have stabilized in both sexes across the globe, possibly suggesting a different biological mechanism.

The reasons for this emerging pattern in adenocarcinomas are unclear. Variations in coding, classification, and diagnostic technology may contribute partially to the observed trends. However, the consistent upward trends observed worldwide across both sexes possibly argue against any of these. Furthermore, the increasing trends in regions of relatively low socioeconomic development suggest that better or improved medical imaging and diagnostic technologies are unlikely to have resulted in the global increase of adenocarcinomas, which otherwise have poor prognosis.

The contribution of some of the known risk factors to the development of these specific cancers may highlight potential explanations. For example, a declining trend in smoking prevalence may partly explain the decreasing trend in lung squamous-cell carcinoma incidence.\(^11\) However, changing designs in cigarettes, as well as changing smoking habits may contribute to the rising incidence of lung adenocarcinoma,\(^11\) especially among female smokers,\(^12\) consistent with a recent finding.\(^13\) Contemporaneously, a rising prevalence in obesity worldwide since 1980, not only in the older cohorts\(^14\) but also among the adolescents\(^15\) is an interesting phenomenon. There is also evidence linking obesity to cancers of the gall bladder, endometrium, colon, kidney, prostate, and breast,\(^16,17\) as well as oesophagus and gastric cardia.\(^3,17\) Does this apparent temporality raise the possibility of linking the development of these adenocarcinomas to excess body weight?

The historic findings of linking in utero diethylstilboesterol exposure to vaginal adenocarcinoma, and the recent debate on hormone replacement therapy may well provide some clue to a biological plausibility. There is speculation that females are more likely to develop lung adenocarcinoma, possibly due to interactions between genetic factors and endocrine status,\(^18\) indicating an underlying gene—environment interaction. So, is it paradoxical that steroidal oestrogen has been added to the list of known human carcinogens recently,\(^19\) or is there a missing link, for example, the influence of physical activity on cancer risk?\(^20\)

The potential relation between excess body weight and cancer risk suggests that excess energy may be an important risk factor for the development of cancer. In animal models, energy restriction has been shown to confer a strong protection.\(^21\) Likewise, biological mechanisms, such as an increase in endogenous production of reactive oxygen species and oxidative DNA damage,\(^22\) as well as an alteration in carcinogen-metabolizing enzymes,\(^23\) may suggest underlying explanations. More importantly, excess body weight, especially increased abdominal fat, mediates an alteration in the metabolism of endogenous hormones, particularly sex steroids and insulin, as well as insulin growth factor (IGF-1). This may stimulate cell proliferation, inhibit apoptosis and can enhance angiogenesis.\(^24\) Recently, ‘hyperinsulinaemia hypothesis’ has gained support, suggesting not only an increased plasma concentration of unbound sex-steroid for bioactivity, but also an increase in IGF-1, which otherwise inhibits the synthesis of sex hormone-binding globulin.\(^25\)

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