

Water, toilets and public health in the Roman era

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ABSTRACT

Toilets have a long history. The aim of this article is to examine the influence of water and toilets on public health during the Roman era (circa 200 B.C.–500 A.D.). Toilets during the Roman era can be divided into two groups: public and private. A public toilet was often built in proximity to or inside a bath so that it was easily entered from both inside and outside of the bath. The abundance of water that was conducted to the bath could also be used to flush the toilet. Piped water for flushing private toilets seems to have been a rarity. In many cases the private toilet was located near the kitchen. Hygienic conditions in both types of toilets must have been very poor, and consequently intestinal diseases have been all around. Dysentery, typhoid fever and different kinds of diarrhoeas are likely candidates for diagnoses. Descriptions of the intestinal diseases in the ancient texts are unfortunately so unspecific that the identification of causative agents is a very problematic venture. Studies of ancient microbial DNA might offer some new evidence for the identification of microbes spread by contaminated water.

Key words | causative agents, public health, Roman era, toilets

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INTRODUCTION

Toilets have a long history. The first evidence of flushed toilet in Europe comes from Bronze Age Minoan (and Mycenaean) Crete in the second millennium B.C.. In the palace of Knossos rainwater was probably used to flush the toilet near the Queen's Hall. Hodge (1992) expressed, however, severe doubts about the efficiency of the drain of the toilet. More than a thousand years later during the Roman Empire the civilized way of life meant that people had entrance to a flushed toilet: either public or private. The purpose of this article is to examine the influence of water and toilets on public health during the Roman era (circa 200 B.C.–500 A.D.).

Toilets can be divided into two groups: public and private. There are no sources that directly illustrate the relationship between water, toilets and public health. We must rely on indirect evidence offered by ancient texts and archaeological remains. At the most one can make enlightened guesses how toilets influenced public health and which intestinal diseases were rife at Roman times.

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PUBLIC TOILETS

The constant flow of the water assured that in towns equipped with aqueduct(s) there was plenty of water to flush the toilets, sewers and streets (Vuorinen 2007). A public toilet was often built in proximity to or inside a bath so that it was easily entered from both inside and outside of the bath (Brödner 1983; Yegül 1992; Manderscheid 2000). This solution for the location of public toilets had two advantages: 1) the abundance of water that was conducted to the bath could also be used to flush the toilet; and 2) the distance to the sewer needed for the bath was short. Typically there were numerous seats quite near each other in the toilet (Figure 1).

In a “standard” public toilet water flowed in two channels (Figure 2). One was under the seats to flush away the faeces. Another conduit of water flowed in front of the seats. Water in this conduit was used to moisten materials, which were used to rinse one's bottom. Occasionally there could have been a water basin in the toilet.



Figure 1 | Roman public toilet located in the forum of ancient Ostia (Photograph taken by Marjatta Vuorinen in 1985).

PRIVATE TOILETS

The archaeological evidence of private toilets (Figure 3) is scant when compared with public toilets. However, at least the inhabitants of Pompeii, Herculaneum and Ostia seemed to consider a toilet to be natural to have in their house (Hermansen 1981; Jansen 1997; de Kind 1998). Generally private toilets had only one or two seats (Wilson 2000). Quite often a private toilet was located under a staircase if located in a multi-storey building.



Figure 2 | Remnants of the water channels running in front of and under the seats are typical remains of toilets discovered in archaeological excavations of ancient baths; a public toilet in a bath in Thuburbo Maius in modern Tunisia (Photograph taken by Heikki S. Vuorinen in 1998).



Figure 3 | A private toilet to be seen in the ruins of a Roman villa in Vilamoura in Portugal. Photograph taken by Marjatta Vuorinen in 1988.

In many cases the private toilet was located near the kitchen, most probably because of the convenience of building a common drain for them. Also, because water was needed for many purposes in the kitchen, this water could easily be reused to flush the toilet. Piped water for flushing was a rarity in private toilets. When a private toilet had a vertical drainpipe, it hardly needed flushing with water.

PUBLIC HEALTH

The poor level of waste management, including wastewater, most probably involved a major risk for public health during antiquity (Scobie 1986; Vuorinen 2007). Toilet hygiene must have been quite poor. The Romans lacked our toilet paper. They probably commonly used sponges, moss, strips of cloth or something similar, which was moistened in the conduit in front of the seat and then used to rinse their bottoms. In public toilets facilities were common to all; they were cramped, without any privacy, and had no decent way to wash one's hands. The private toilets mostly lacked running water and also an adequate opportunity for hand washing and were quite commonly located near the kitchens. Contaminated hands of users of public and private toilets spread the intestinal pathogens from one person to the next and to food and drink of other people, thus creating good opportunities for intestinal disease epidemics.

The accumulation of faeces in the drains made the toilets even more unhygienic and the stench from the toilet drains must have been nauseating—there were no odour

traps. Because the gradient was insufficient to prevent the settling of solids, including the faecal matter, in an ancient conduit drain, periodic cleaning was necessary (Wilson 2000).

Water-borne infections must have been among the main causes of death at least in Roman towns (Grmek 1989). Dysentery and different kinds of diarrhoeas have played havoc with the populations (Lim & Wallace 2004). That the ancient world was plagued by diarrhoeas and dysentery is evident in numerous references in the medical authors (*Airs, Waters, Places*. 7; *Aphorisms*. III. 11, 21, 22; *Epidemics* VII. 82; *Internal Affections*. 21, 23, 26, 34, 45, 47; Celsus. *De Medicina*. II. 8. 30–33). Although the ancient medical writers described different kinds of intestinal diseases, the identification of the causative agents and the retrospective diagnoses are difficult (Stannard 1993).

The mortality of children, especially recently weaned, must have been high, which is probably echoed in the following passage of a Hippocratic author in the late fifth century B.C.: “*It is mostly children of five years that die from this disease (dysentery), and also older ones up to ten years; other ages less.*” (*Prorrhetic* II. 22) Celsus in the first century A.D. also mentioned the danger of diarrhoea for children up to the age ten (Celsus. *De Medicina*. II. 8. 30).

Summer and early autumn, when water resources were meagre in the Mediterranean world, must have been a time when drinking water was easily contaminated, and diseases were rife. Several passages in medical writings illustrate this, e.g. a Hippocratic author in the late fifth century B.C. “*I wish now to treat of waters, those that bring disease or very good health, and of the ill or good that is likely to arise from water. For the influence of water upon health is very great. Such as are marshy, standing and stagnant must in summer be hot, thick and stinking, because there is no outflow; and as fresh rain-water is always flowing in and the sun heats them, they must be of bad colour, unhealthy, bilious. ...For in the summer there are epidemics of dysentery, diarrhoea and long quartan fever, which disease when prolonged cause constitutions such as I have described to develop dropsies that result in death. These are their maladies in summer ...*” (*Airs, Waters, Places*. 7).

It should also be kept in mind that the salubrity of toilet systems differed markedly in accordance with the social status of the people. The rich had their own baths and

private toilets in their luxurious houses (*domus*) or villas. The poor had to use public baths and toilets or common toilets under staircases of multi-storey buildings. All this must have caused differences in the health of rich and poor people.

CAUSATIVE AGENTS

Some hypothesis can be made about the causative agents of the diseases caused by the unhygienic conditions (Table 1). Identification of DNA sequences supposed to be from *Salmonella enterica* serovar Typhi in dental pulp from probable victims of the Plague of Athens (430–426 BC) gives some support for the existence of typhoid fever during antiquity (Papagrigorakis *et al.* 2006a; Papagrigorakis *et al.* 2007). Although there are problems in the identification of ancient bacterial DNA (Shapiro *et al.* 2006), dental pulp might be an ideal DNA source of ancient septicaemic microorganisms, like causative agent of typhoid fever (Papagrigorakis *et al.* 2006b).

Some modern authors, like Scobie (1986), include in their list of common intestinal diseases during antiquity also cholera. In a way Scobie is correct. The Hippocratic authors in the fourth century B.C. were already familiar with the word cholera (χολέρα) (*Aphorisms* III. 30; *Epidemics* V. 10, 71; *Epidemics* VII. 82; *Affections*. 27). Cholera (χολέρα, η) was also a word used by Galen in the second century A.D. (Durling 1993). However, during antiquity the word cholera (and derivatives of it) referred to an unspecific disease with symptoms of diarrhoea and vomiting often accompanied by

Table 1 | Causative agents of diseases spread by the unhygienic conditions in the toilets in Roman times

Disease	Causative agent
Diarrhoeas	Bacteria, e.g. salmonellae, and viruses, e.g. enteroviruses
Dysentery, both bacillary and amoebic	Several types of <i>Shigella</i> bacteria and <i>Entamoeba histolytica</i>
Typhoid fever	<i>Salmonella enterica</i> serovar Typhi, or more probably an ancestral strain of it.
Intestinal symptoms caused by various intestinal parasites	Several species of intestinal helminths and protozoans

abdominal pains. “At Athens, cholera (χολέρα) seized a man. He vomited and had diarrhoea and pain. Vomiting and diarrhoea could not be stopped, and his voice failed, and he could not move from his bed, his eyes were misty and hollowed, he had spasms from the intestine like hiccups. The bowel movements were greater than the vomit. ... And he survived. ...” (Epidemics V. 10) But Scobie is also mistaken. Cholera mentioned by the ancient authors cannot be identified as the cholera caused by *Vibrio cholerae*. Medical historians who are familiar with the history of cholera seem to be unanimous that outside the Indian subcontinent the cholera caused by *Vibrio cholerae* spread first in the 19th century. It was in the year 1854 that the Italian Filippo Pacini was the first to accurately describe *Vibrio cholerae*.

Although there was not the cholera, diarrhoeas and dysentery were around (Table 1). Grmek (1989) lists among the acute forms of gastroenteritis that were around: typhoid fever, bacillary dysentery, amoebiasis, and diseases caused by salmonellae and enteroviruses. Grmek (1989) is even confident enough to diagnose a case of amoebic dysentery (Epidemics VII. 55) and suspecting it in several other cases. Dysentery is also among the diseases considered to be common in ancient Greek and Roman world by Stannard (1993). Dysentery (δυσεντερία) and diarrhoea (διάρροια) were well known diseases for a Hippocratic author in the early fourth century B.C. (Affections. 23, 25). Galen was also very familiar with both diseases (διαρροία, η; δυσεντερία, η) (Durling 1993).

CONCLUSION

Toilets during the Roman era can be divided into two groups: public and private. Hygienic conditions in both types of toilets must have been very poor, and consequently intestinal diseases have been all around. Some diseases are more probable than others. Dysentery, typhoid fever and different kinds of diarrhoeas are likely candidates for diagnoses. For cholera one must be quite sceptical. Descriptions of the intestinal diseases in the ancient texts (e.g. Hippocratic writings) are unfortunately so unspecific that the identification of the causative agent is a very problematic venture. Studies of ancient microbial DNA

might offer some new evidence for identification of microbes spread by contaminated water. Septicaemic microorganisms (like the causative agent of typhoid fever) might be identified from the dental pulp of their victims.

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