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## Tudor Naval Medicine 1485 – 1603: Part Two <sup>1</sup>

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### INTRODUCTION

THIS IS THE SECOND OF A TWO-PART ARTICLE on English naval medicine during the Tudor period. Both parts follow a previous article on medieval naval medicine, with the same aim of making comparisons with contemporary ADF practice in order to identify common issues.<sup>1</sup> Like the previous article, they are based on information from the first of a four-volume history of naval medicine, written by Surgeon Commander. Keevil RN (Rtd) in the late 1950s.<sup>1</sup>

The first part described Tudor medicine from a naval viewpoint and Tudor ships from a medical viewpoint'. This part will discuss the medical aspects of Tudor naval operations.

### TUDOR CAMPAIGNS AND DEPLOYMENTS

After 1450, the ability to keep ships at sea was only limited by recurrent failures with their victualling and/or hygiene. By 1565 the daily standard ration for an English sailor was a gallon of beer, a pound of bread or biscuit, with beef, pork or fish, plus butter and cheese, supplemented where possible by fresh food at the men's own expense. The meat was preserved by drying and packing in salt pickle, but poor or skimped technique led to frequent preservation failures.

Early English naval medicine was also influenced by trade in the Mediterranean from 1457. In 1504, Henry VII hired his ships Sovereign and Regent to merchants for a voyage to the Levant,<sup>1</sup> where they encountered the Venetian quarantine regulations which had been established in 1485. Quarantine was first introduced at Marseilles in 1383, while Pisa had established the first quarantine station in 1464.

Meanwhile, Portuguese and Spanish royalty had sponsored Bartholomeo Diaz' voyage to the Cape of Good Hope in 1487, Columbus's passage to America in 1492 and Vasco da Gama's journey to India in 1498.<sup>1</sup> However, as Henry VII wished to avoid conflict, it was not until 1496 that he allowed John Cabot to explore northern America with five ships, where he discovered Nova Scotia and Newfoundland.<sup>1</sup> Further English expeditions were restricted by Henry VIII's wars with France and it was not until Elizabeth I's undeclared war with Spain that the merchant adventurers reached their full potential.

As Elizabeth's own fleet was unable to defend England themselves, private citizens were encouraged to sponsor long voyages for trade, exploration, and/or plunder. As a result, Tudor maritime power was based upon these privateers rather than the Queen's ships, such that 80% of the 197 ships opposing the Spanish Armada were either armed merchantmen or privately owned warships.<sup>1</sup> Besides safeguarding England from Spanish invasion, the Armada campaign also demonstrated that the ocean trade routes were open to those who fought for them. Within a dozen years, several European nations had also formed their own East India trading companies.<sup>1</sup> It took another century, however, for England's navy to dominate maritime affairs and it was not until 1815 that the Royal Navy "ruled the waves".

These longer voyages were soon accompanied by the associated medical problems, although given the epidemics, starvation, poor hygiene and lack of medical care in Tudor England, it is perhaps debatable whether they were more or less dangerous than staying home. Although a likely reason for English maritime supremacy is that it

learned how to conserve its seamen sooner than their Portuguese, Spanish, Dutch and French competitors, this still did not occur until after the 1750s.

Vasco da Gama returned to Europe from India in 1499, having lost half of his ships and two thirds of his men, who represent the first documented victims of the scurvy that wreaked so much havoc over the next three centuries.<sup>2</sup> The most bewildering aspect of scurvy was how the cure was repeatedly found and lost, although it was also frequently used as a plausible cause to justify the failure of a particular expedition.<sup>2</sup> The humoral theories of disease also militated against finding a cure, as these depended on imbalances of nature: as man was derived from the four basic elements, scurvy was the result of excessive time at sea. Against this, the application of actual practical experience had little effect.

The 19 deaths from scurvy during Magellan's circumnavigation in 1519-1522 may have encouraged shorter transatlantic efforts but, if so, this made little difference.<sup>2</sup> Having discovered Canada the previous year, during the winter of 1535, Jacques Cartier lost 25 men from scurvy while exploring the St Lawrence River. He was left with only three men who were fit enough to go below and, had it not been for antiscorbutic advice from the locals, no one would have survived.<sup>2</sup> Following a suggestion by Sebastian Cabot, Sir Hugh Willoughby left with three ships in 1553 to search for a route to China via Russia. Cabot had framed the first known written set of hygiene rules, including Item 15 and 18:

*" Item 15: No liquor to be spilt in the ballast, nor filthiness to be left [in] board: the cook room and all other places to be kept clean for the better health of the companie ..."*<sup>2</sup>

*" Item 18: The sick e, diseased, weak e and visited person within boar, to be tendred , relieved , comforted and holpen in the Lime of his infinnitie, and every manner of person, without respect , to beare another's burden."*<sup>2</sup>

However, despite having three surgeons and these instructions, only one ship made it to Archangel, while the others were frozen in off eastern Lapland, where they were found by Finnish fishermen the following spring with no survivors.<sup>6</sup>

Even so, the ability to promulgate and apply these hygiene rules to the royal ships was limited. Not only were there no administrative arrangements for their dissemination, but the Divine Right of the sovereign meant that any attempt to apply instructions not directly emanating from the Crown was considered treasonous.<sup>2</sup>

The first recorded example of disease influencing a naval campaign was in 1544, when a French fleet was defeated, not by Henry VIII's ships, but by dysentery which prostrated entire crews on both sides. Besides losing the Mary Rose the following year, the 1545 campaign was noteworthy for a "plague" in 11 of Henry's ships, affecting one quarter of his 12,000 men. He had gathered his fleet with great haste, resulting in a requirement for large quantities of poorly preserved provisions at short notice. While the need to avoid moving men between ships was recognised, there were no quarantine procedures, no link was made with the victualling and no medical advice was sought. Henry wisely responded by demobilising his fleet.<sup>2</sup> Another period of naval neglect led to the decimation of an English expedition to France by an epidemic in 1558, probably related to another victualling failure.<sup>2</sup>

Thomas Wyndham's expedition to Benin (West Africa) in 1553 was left with only 40 survivors out of 140 due to yellow fever, while subsequent expeditions to the area introduced English seamen to malaria.<sup>2</sup> John Hawkins made slaving voyages for the Spanish market to West Africa in 1562, 1564 and 1568, initiating a trade with high risks, high profits and high mortality (especially for the "cargo"). Although his first voyage was disease free and only twenty men were lost on the second, his third voyage ended in disaster when he was ambushed by the Spanish at San Jan de Ulloa in the West Indies.<sup>5</sup> As a result, John Hawkins' younger kinsman Francis Drake learned to carry a surgeon on board and this was reinforced when Drake was wounded during a reprisal raid on Panama in 1572-3.<sup>1</sup>

In December 1577, Drake left England for the Pacific in five ships, carrying 164 men including two surgeons. On the way south, Drake asserted that it was the ship's captain rather than the gentry or soldiers who commanded at sea, by hanging the senior gentleman, Thomas Doughty, for mutiny.

On reaching the Pacific via the Straits of Magellan, his ship Golden Hind was alone. As her master surgeon had died and his mate was no more than "a boy, whose good will was more than any skill he had", it was Drake himself who treated nine wounded men, despite himself having been grazed under the eye by an arrow. Fortunately, like most seamen, his officers had some first aid knowledge.<sup>2</sup> Fifteen months after leaving England, Drake still had 85 men fit and well by obtaining fresh supplies as he plundered various settlements and treasure ships along the American west coast. No sickness appeared until April 1579 off California, where Drake abandoned his search for a Northeast Passage and crossed the Pacific to the East Indies, taking 68 days with the inevitable scorbutic result. After a month to recover, he proceeded home, returning to Plymouth in September 1580.<sup>2</sup>



Left: Replica of Drakes Golden Hind  
Length: 70ft (21.3m)  
Beam: 19ft (5.8m)  
Depth: 9ft (2.7m)  
Displacement c150t  
Rigging: Three masted square rig with lateen mizzen  
Armament: 18 guns  
Complement: 80-85

The first English expedition to China and the East Indies via the Cape of Good Hope left in 1582. Despite being better equipped than many earlier expeditions, the four ships returned the following year, having failed to leave the Atlantic. The names of three surgeons have survived, including John Banester (1540-1610), who lost 45 men (one third of his crew), of whom only three were surgical cases. As previously recounted, in later years Banester lectured on his experiences to apprentice barber-surgeons.

In 1585 Elizabeth lent six ships to Drake for an expedition to the West Indies. All went well until he raided the Cape Verde Islands, where 300 out of 2400 sailors and soldiers died of malaria. The mosquitoes were brought on board, leading to more deaths en route to Dominica and the outbreak only ended in the colder latitudes on the way home. One third of the men died and the link between mosquitoes and disease was missed.<sup>2</sup>

On a more successful note, Thomas Cavendish left for the Pacific in July 1585 with three ships and 123 men. Although this was his first voyage, it seems he had learned from his predecessors, collecting lemons in West Africa and having no scurvy. The only death from wounds was a man shot by an arrow, who had only removed the shaft and refused to let the surgeons remove the head. Cavendish lost only two men from scurvy while crossing the Pacific and one death from illness (possibly dengue) between Java and the Philippines, before his two surviving ships returned home in September 1588.<sup>2</sup>

However, in 1589, James Lancaster left for the East Indies and made a disastrous voyage home from the Nicobars (off Sumatra) with only 33 survivors. A second attempt in 1591-4 with three ships was no more successful, with scurvy appearing early in the voyage forcing one ship to return with 50 invalids. Four men were killed by lightning and 32 by natives near Zanzibar, while Surgeon Arnold of the Penelope died from probable heat exhaustion. On the way home, dysentery forced more men to be landed at St Helena with the second surgeon, where they recovered. Both voyages were to stand him in good stead for his third voyage, in 1601 with the English East India Company.<sup>2</sup>

## THE SPANISH ARMADA

Preparations for a Spanish invasion of England had begun in 1584.<sup>7</sup> After Drake's attack on Cadiz in 1587 successfully delayed its departure, Elizabeth laid up the fleet to save money. The crisis the following year

overtook a nation enfeebled by years of poverty and malnutrition. No preventive health lessons from 1545 or 1558 were learned.<sup>2</sup> No clothing was supplied, allowing lice and fleas (hence typhus) on board.<sup>2</sup> Landsmen aboard ship failed to conform to the basic hygiene standards now accepted by experienced sea-men, while none were allowed ashore or to undress on board.<sup>2</sup> No arrangements were made for the sick and wounded, and the Company of Barber-Surgeons was not even asked for extra surgeons. By then sea-surgeons were in more or less regular employment and paid the same monthly scale as seamen (10 shillings per lunar month plus two pence per man), but insufficient numbers led to the impressment of unqualified "quacks".<sup>2</sup> The wounded were taken below to the cable tier or laid on the ballast until the fighting was over. In this situation, sea-surgeons could often do little and the wounded were landed in accordance with the Laws of Oleron.<sup>2</sup>

Nevertheless, it was the victualling that led to an English medical catastrophe, with unsanitary conditions and toxic food poisoning taking their toll after as little as a fortnight at sea.<sup>2</sup> The Elizabeth Jonas lost 200 out of 500 men in three weeks while waiting for the Armada in Plymouth. After sending the survivors ashore, removing her ballast and disinfection, she took on a fresh crew, only to lose even more men while pursuing the Spanish fleet.<sup>2</sup> The Privy Council asked the College of Physicians for help and, although four physicians visited the fleet, they could do little. In the event it was the beer (drunk instead of water as it kept better) instead of the victuals that received the blame.<sup>2</sup> The key problem for the English was that, despite Henry VIII's administrative innovations, their shore organisation remained inadequate.<sup>1</sup>

The Armada had 130 ships, of which only 25 were purpose-built warships,<sup>1</sup> while of its 30,000 men, only about 8,000 were seamen. It also had no less than 180 priests but only six physicians and surgeons each, albeit with 62 medical orderlies. The Spanish ships were of the old fashioned "high-charged in type, with high castles to facilitate boarding. The internal organisation of the Spanish ships was the same as their galleys and was comparable to a land fortress, with three classes: soldiers, gunners and sailors. As Spanish ship's captains were only the equivalent of English masters, they were therefore subordinate to the senior military authority, leaving the sailors with the ancient role of getting the ship where the soldiers could board the enemy.<sup>5</sup> As only a few Spanish ships displaced more than 500 tons, overcrowding was a significant problem,<sup>1</sup> yet there were too few seamen to handle the ships effectively.

Armada flagship San Martin

Length: 122ft (37.3m)

Beam: 30ft 5 in (9.3m)

Displacement: 1000t

Rigging: Three masted square rig with lateen mizzen

Armament: 48 guns

Complement: 350 seamen and gunners, plus 302 soldiers



This contrasted with the English, who had 197 ships with about the same number of purpose-built warships as the Spanish. However, of its 16,000 men, over half were seamen, thereby allowing better ship-handling. The sea men also fought their own guns, thereby avoiding the need for separate gunners who could not sail the ship. Furthermore, as their "race-built" ships were faster and more maneuverable than the Spanish ships, the English has the initiative. Finally, in English ships the few soldiers on board were subordinate to the captain, who intended to fight using long-range gunfire instead of boarding.

English flagship Ark Royal

Length: 140ft (42.6m)

Beam: 37ft 5 in (11.2m)

Depth: 15ft (4.5m)

Displacement: 690t

Rigging: Four masted square rig with lateen mizzens

Armament: 38 guns

Complement: 304 seaman and gunners, plus 126 soldiers



The Armada was ready to depart Lisbon on 25 April 1588, but it did not get to sea until 30 May. Adverse weather and an inability to beat upwind meant it was not until 29 July that it entered the English Channel. These delays and poor food preservation meant, like the English, their huge store of victuals was also going rotten, but without the possibility of resupply. Water supplies were limited to three pints of water per day for cooking and drinking, even before it was found that many water barrels were empty or leaking. The Spanish soldiers were kept below, where they ate and slept in overcrowded and wet conditions, on the bare decks amid vomit and excreta. The effluvia were occasionally washed into the bilges with seawater, where it poured over their decomposing food and tainted water. The bilge pumps discharged their contents only as far as the upper deck, where it either found its way overboard, or was recycled back below. Gastrointestinal disease was therefore inevitable, along with typhus secondary to the lice and fleas that quickly made their way through the overcrowded ships.<sup>1</sup>

Meanwhile, the English searched for the Armada, but failed to make contact until after it entered the Channel. The English fleet sailed from Plymouth and began a series of running battles. Initially there were about 100 English ships, of which only 69 were galleons or galleon-built merchant ships. Despite the better maneuverability of the English ships, their shooting at long range proved ineffective, allowing the Armada to maintain its course and formation with the loss of only three ships (only one by enemy action).<sup>5</sup>

The Armada anchored off Calais on 6 August to rendezvous with a force from Spanish Holland for the invasion. Disaster struck the Armada the following evening when it was broken up by English fireships, after which it was driven east into the shallow water off Gravelines. Having discovered close-range gunfire to be more effective, the reinforced English fleet quickly destroyed four ships and inflicted about 600 killed and 800 wounded before exhausting their ammunition.<sup>5</sup> In response, the Spanish gunfire was negated by poor ammunition, while their attempts to board were easily avoided by their more maneuverable "race built" opponents.<sup>7</sup> The Armada avoided total catastrophe only after a wind change allowed it to head north, when the decision was made to return to Spain via Scotland and Ireland.

The English left the Armada to its fate off the Firth of Forth on 13 August, having lost no ships and less than 100 men in action, although total losses from illness are unknown.<sup>5</sup> As they dispersed to various ports along the east coast, the naval administrative system broke down completely, while an epidemic of typhus revealed the limitations of the Laws of Oleron in dealing with large casualty numbers. On 29 August the English fleet commander, Lord Howard, wrote:

"It were too pitiful to have men starve after such a service. I know her Majesty would not, for any good. Therefore I had rather open the Queen majesty's purse something to relieve them than they should be in that extremity; for we are to look to have more of their service; and if men should not be cared for better than to let them starve and die miserably, we should very hardly get men to serve. Sir, I desire that there may be double allowance of but as much as I give out of my own purse, and yet I am not the ablest [wealthiest] man in the realm; but before God I had rather have never penny in the world than they should lack."<sup>5</sup>

In the event, for many men Howard's plea came too late.

Meanwhile, the Spanish had 3,000 typhus cases as well as the wounded, while even in the best-provisioned ships, three or four men died daily from starvation and thirst.<sup>5</sup> Many ships disintegrated in the north Atlantic autumn and sank without survivors, while at least 26 ships were wrecked on the Irish and Scottish coasts. Many shipwreck survivors were murdered, either by the locals or by the English.<sup>7</sup> Up to half of the Spanish ships never returned home, while the dead probably totalled about 20,000. The dead included about 1,500 killed in action, 6,000 lost at sea, 1,000 by judicial or other murder ashore, and the rest by starvation and illness.<sup>7</sup>

#### **AFTER THE ARMADA**

In 1589, Drake led an expedition of over 140 ships to Portugal, but another victualling debacle created problems for his soldiers ashore. After re-embarkation, Drake cruised between the Azores and Vigo before returning to

Plymouth with little accomplished, having lost half of his 13,500 men from disease. Despite advancing £253 for medical and surgical supplies, the medical resources had proved inadequate and the lack of experience and expertise of the surgeons was also severely criticised.<sup>2</sup>

In 1591, the Spanish caught an English fleet under Lord Howard off the Azores, with half of his men sick after yet another victualling failure and cut off Sir Richard Grenville's *Revenge* from the rest of the English fleet. However, despite having 90 of her 190 men ill in her hold, *Revenge* held the Spanish off for 15 hours, losing 40 killed and most of the rest wounded, before exhausting her ammunition. After she surrendered, *Revenge's* hold flooded drowning her sick, and she later sank in a storm with all her survivors and prize crew.<sup>2</sup> The Spanish dead were estimated to be between 400 and 1000."

Cavendish left Plymouth for the Pacific with five ships in August 1591 and this time was less lucky, with scurvy leaving him with one ship and 27 men alive out of 76, before they even reached the Straits of Magellan. Although they recovered by eating "scurvy-grass" and penguins, another 11 died on the way home (possibly from "wet" beri-beri), and with only five men able to work the ship, on arrival she had to be run ashore.<sup>2</sup>

In 1593, John Hawkins' son, Richard, sailed for the Pacific with three ships. Scurvy developed near the equator and, although he had seen "10,000 men with this disease", Richard still failed to link it to the cause. Despite recognising the value of fruit juice as a cure, this was lost within a plethora of theories, such as the sea air, having a dirty ship and lack of exercise. By the time Richard Hawkins reached Santos in Brazil, rats had eaten 80% of his victuals and he only had 24 men fit. His crew recovered with oranges and lemons and remained well until they met a Spanish fleet off Chile, where they had to surrender after a two day battle.<sup>2</sup> Although the English surgeons had lost most of their instruments, they lost no English wounded and they even treated the Spanish casualties after their surgeons proved incompetent. This was probably the first time naval surgeons had made such a positive difference in treating the wounded. It was in such ships that the relationship between captains with strong medical views and surgeons with limited authority evolved into an effective partnership.'

In February 1595, Sir Walter Raleigh sailed with five ships to search for El Dorado in modern Venezuela and Guiana. The main medical interest was Raleigh's evidence that mosquito-borne disease had not yet been carried into this area.' However, concerns regarding his credibility were supported by another expedition to the area by Sir Olave Leigh in 1604, which led to nine deaths out of 46 from illness.' They were also: "mightily vexed with a kind of Worme (chiggers), which at first was like a Flea, and would creep into the feet especially and under the nayles, and would exceedingly torment us, the time it was in, and more in the pulling out with a Pinne or Needle if they were few. But one of our men having his feet over growne with them, for want of hose and shooes, was faine to submit himself to the Indians cure, who tying one of his legges first with his feet upward, powered hot melted wax which is blacke upon it, and letting it lye upon it till it was thoroughly cold, the forcibly pulled it off; and where with all the Wormes came out sticking in the same, seven or eight hundred in number.'"

Another Caribbean expedition the same year was decimated by dysentery, which became an accepted inevitability of visiting the area. Like scurvy and fresh food, the link between dysentery and water quality was missed for centuries. This was evident in the expedition of 21 ships and 2,500 men under Drake and John Hawkins, which left Plymouth for the West Indies in August 1595. The medical preparations seem to have been very good, with Chief Surgeon James Wood, several assistants and medical chests, as well as two spare chests costing £33.16s.2d. each. Slop (spare) clothing was available, as well as advice from Hugh Platt (1552- 1608) regarding water and other stores. Years later Platt wrote *Certaine Philisophical preparations of Food and Beverage for Seamen*, in Their Long Voyages, extolling the virtues of boiling and then sealing food, anticipating the development of tinned food 200 years later. He also suggested macaroni as a cheap, fresh and lasting victual, which he thought might have had a useful role at sea.'

However, in spite of these preparations, John Hawkins died off Puerto Rico after a six-day illness in November 1595, and on 15 January 1596 Drake himself fell ill, lingering for a fortnight before dying at sea on 28 January, shortly after Wood. By 6 February another 500 men had joined them and the survivors sailed home after scuttling

some ships to man the rest.<sup>1</sup> A fourth expedition that year had the same result, with the onset of a "bloody flux and other dis tempers" forcing a return to England.<sup>1</sup> This expedition's chaplain left a description of the illness:

"It was and extreme looseness of the body, which within a few dayes would grow into a flux of bloud, sometimes in the beginning accompanied with a hot Ague, but always in the end attended by an extreme debillitie and waste of spirits: so that some two days before death, the arms and legs would be wonderful cold. And that was held for a certain sign of neere departure. This sicknesses usually within a few days (for it was very extreme to the number of sixtie, eight i.e., and one hundred stooles in an artificiall day) brought a languishing weaknesses all over the body, so that one mans sicknesses (if he were of any note) commonly kept two from doing duties."

This suggests it was typhoid that killed Hawkins, Drake, Wood and so many others.

An expedition to Cadiz in 1596 under Admiral Lord Howard included physician Dr Roger Marbeck, possibly to ensure the care of the Queen's favourite, Lord Essex. The expedition was moderately successful with only a few wounded and no illness.<sup>1</sup>

Surgeons were carried in all these expeditions because the voyages were of great length and the men were exposed to enemy attack. However, as there was no central body for recording their experiences, there was no accumulation of knowledge, which meant the same mistakes were made again and again. It was the English East India Company that later provided such a repository, requiring its surgeons to write medical journals which allowed a scale of medical equipment to be developed for use at sea. The provision of surgeons to East Indiamen later became an important duty for the Barber-Surgeons as it was for the navy and army. The East India Company received its Royal Charter on 31 December 1600 and the following year an expedition left Tor Bay with five heavily armed ships and 480 men under Lancaster. Each ship had two surgeons and a barber each, with each surgeon receiving an allowance of between £20 and £32 for their chests. Having a surgeon and a mate quickly became Company policy as they fought the Portuguese and Dutch for the East Indian markets.<sup>1</sup>

Although Lancaster was able to establish bases or "factories" in Sumatra and Java, the human cost was high, particularly in the Doldrums where calms led to 105 deaths from scurvy.<sup>2</sup> However, by issuing three tea spoons of lemon juice each morning, his own ship remained relatively scurvy-free. Having also used lemons to "purge the scurvy" in Madagascar, Lancaster is credited as the first seaman to use them for both prevention and treatment.<sup>2</sup> However, his success was lost in a plethora of other theories as to its cause, as was his linking of dysentery and water quality. In December 1601 his surgeon, Christopher New church, took poison, not having either the training or anything in his chest to help his patients, while another surgeon died from natural causes. By the time he returned to England in mid-1603, Lancaster had lost over 180 men.<sup>2</sup>

## CONCLUSION

The disruption of the English social order, combined with the decline and eventual abolition of the religious orders, destroyed many of the rudimentary health institutions that existed at the end of the Middle Ages. It is ironic that the demand for these institutions increased as English sailors ventured further overseas. Tudor overseas trade was fraught with health risks, both at sea and ashore. The seeds for destruction from scurvy, typhus and dysentery were often sown even before the ships left port, as a result of poor victualling and worse hygiene practices. Even if these had been better, it is probable little could be done regarding the exotic diseases (such as yellow fever and malaria) that wreaked so much havoc, given the inability to even differentiate, let alone diagnose them. There was also a lack of natural immunity to foreign illnesses, although indigenous peoples probably did even worse when exposed to exported European illnesses.

Furthermore, sea-surgeons were there only to treat wounds rather than illness, even when it was the latter that jeopardised the success of the various deployments. They were further hamstrung by legal constraints on their training, which actively prohibited their acquiring any expertise in internal medicine. However, even if they had the training, the level of therapeutic support was limited to hiding rather than treating the cause and, in any case, the

physicians' reliance on humoral medicine further militated against their effectiveness. As a result, it is hardly surprising that mortality rates during these voyages sometimes reached suicidal proportions.

Nevertheless, despite the emphasis on theorising at the expense of experimentation and practical experience, some faltering advances were made. The treatment of scurvy had been recognised, and connections had also been made between water quality and dysentery, and mosquitoes and malaria. These connections were probably lost not once but several times, not only because of a lack of peer support, but also because as yet there was no naval medical administrative system.

The story of Tudor naval medicine is therefore one of multiple disasters among occasional successes, the latter including Cavendish's 1585-8 circumnavigation and the post-action casualty care for Richard Hawkins' expedition in 1593. Since the period essentially defined the medical problems associated with going to sea, it was up to their professional seaman and medical successors to develop the solutions.

Comparison of the Tudor period with the provision of ADF medical support in the 21st century suggests at least four common issues. Firstly, it is noteworthy that, despite advances in food technology over the last 450 years, gastroenterological illness remains one of the five major causes of morbidity in deployed forces.

Secondly, it has previously been discussed how the provision of non-operational health support was as much an issue in medieval England, as it remains in 21st century Australia.' It will be recalled that the Laws of Oleron focussed on paying for sailor's health care, rather than ensuring that the health care itself was actually available. As there were no internal health care providers, this was only available from the medieval equivalent of external providers. However, after 1500 this rudimentary health care system began to be overwhelmed by the sheer number of disabled seamen, at a time when the loss of the charitable institutions had curtailed the health care ashore for any one, let alone sailors. At a time when life was cheap and early death inevitable, apart from the efforts of Drake, Cavendish, Richard Hawkins and Lancaster, a key failure during the Tudor period was in not conserving scarce personnel ashore in order to maintain fighting efficiency afloat. It was not until the 1650s that the need for effective health support to conserve personnel assets was first recognised.

Thirdly, the Tudor period illustrated how the relationship between commanders and health providers began to evolve into an effective partnership. Even despite the limitations of Tudor medical knowledge, Richard Hawkins and his surgeons demonstrated the synergy that can be achieved when, health providers understand their commander's mission objectives and the commanders understand the health provider's requirements in order to facilitate meeting those objectives. Conversely, the Tudor period abounds in examples where either commanders and/or health providers attempted to function independently of each other, invariably to the detriment of the mission objective. It is suggested that this issue remains pertinent to the ADF.

Finally, it has also been previously noted that the need for deployed health assets to treat more than just battle casualties remains an issue for some ADF operational planners. This in turn still has ongoing implications for the status, remuneration, training and legal standing of ADF medical officers.

The low status of Tudor naval surgeons was compounded by low recruiting standards and the tendency for the hierarchy to employ and promote junior medical practitioners irrespective of their professional qualifications. Pay was linked to that of seamen, with an additional allowance that was intended to reflect their special skills but was without reference to civilian qualifications or remuneration. As early as 1588, Clowes had identified the importance of knowing how to improvise in austere environments and had developed the first (unofficial) naval Medical Allowance List (MAL). It is noteworthy that his MAL extended beyond that required to treat battle casualties and that he and his professional colleagues lacked the legal authority to prescribe some items.

Although one would hope recruiting standards have improved since the Tudors, the use of independent medical assistants in the Australian and other navies reflects the need to have some form of health support at sea even when there is no medical officer available. Both this need and the solution were first identified by Henry VIII's navy over 450 years ago. Pay for ADF MOs still reflects a modified "Officer's Commons Scale" that bears no relationship



to civilian qualifications or remuneration. Although (unlike their Tudor forebears), permanent and reserve ADF medical officers can practice both medicine and surgery, they still share with them the fact that their professional predeployment preparation is often still less than ideal. Finally, medicolegal concerns continue with respect to providing health services to an acceptable civilian standard, despite the limitations of the deployed environment ashore and afloat.

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