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METHODS

This report surveys incidence of injuries and illnesses on the BT Global Challenge September 1996 to July 1997. Over 300 amateur sailors on 14 identical (monotype with identical deck and cockpit layouts) yachts sailed in the race, and no participant was excluded from analysis. Each yacht had 14 crew, of whom one was a professional skipper alongside 13 amateurs including two additional crew for each leg of the race. Each amateur crew member paid a berth fee of £18 000 for completion of the entire race, and a pro rata rate was applied to individual leg participants. Minimum and maximum age was 21 and 60 years respectively. A total average circumnavigation time at sea was 170 days, representing 2380 crew days. From a total of 365 participants, 283 male and 82 female, 140 circumnavigated, with the remaining 225 completing between one and five legs of the race. Crew volunteers had undergone a core sail training of variable duration before the race. Subsequently, all crew trained with individual professional skippers who remained solely responsible for training and safety. The race provided medical care. A case was defined as any one medical incident that began and ended during the race.

Conclusion: Injury and other forms of medical problem are relatively common in an amateur long distance ocean yacht race. Most can be adequately managed at sea, provided that optimal communication, training, and equipment are provided and maintained.

Objectives: To quantify the incidence and type of medical problem arising during an amateur circumnavigation yacht race, the BT Global Challenge. Methods: All cases from 14 participating yachts in a confidential medical log completed by an appointed medic were reported. Results: A total of 685 cases were reported, of which 299 (43.6%) were injuries and 386 (56.4%) illnesses. The subtype of injury, illness, and three evacuations at sea are described.

Omnim are the environment of the world have been increasingly accessible to amateur yachtsmen, but with safety remains an issue encompassing accident prevention, safety equipment, management of accidents and emergencies, and the role of the rescue services at sea. In this paper we document the medical aspects of an amateur trans-globe ocean yacht race. The British Telecom (BT) Global Challenge was undertaken by a predominantly amateur crew, while ensuring that safety is not unduly compromised. Such principles are specifically directed towards improving the outcome of medical and surgical problems arising at sea. A race provided a source of data, as a medic aboard each yacht kept confidential medical records throughout the race; this is something that has not been achieved in other international ocean races. In addition, the race was an appropriate forum for such a study given its 10 month duration, its course, and the weather conditions encountered.

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to T&T. Statistical assessments were made for injury incidence for particular yachts or legs of the race; p<0.05 was deemed significant.

RESULTS
Table 1 gives reasons for excluding potential volunteers on the basis of the questionnaires completed before the race.

The results of all logs were analysed. No deaths of crew members were recorded, and three medical evacuations occurred. Two involved the Royal Navy to evacuate to the nearby Falkland Islands and one to the island of St Helena.

Three of the 14 logs were incompletely filled out when there was a change of appointed medic between legs. A total of 685 cases were reported over a six month period at sea. The largest number was recorded for particular yachts or legs of the race; p<0.05 was deemed significant.

Injuries on board
Abrasions and contusions featured most prominently (108/299; 36.1%), and were treated with a combination of support, non-steroidal anti-inflammatory drugs, and basic support techniques. T&T did not have a significant excess of injuries (p = 0.14; Kolmogorov-Smirnov test based on 13 totals excluding T&T and T&T’s total number of injuries). Cases were minor and required no onshore medical follow up. Burns, including thermal, rope, and sun, made up 15.7% (47/299) of injuries (fig 1). Fractures comprised 11.0% (33/299) of injuries and were all closed. Types of fracture included ribs, clavicle, wrist, and tibial plateau. Suspected fractures, where there was persistent pain or disability, were confirmed radiologically ashore. After immobilisation, analgesia was achieved using tramadol and non-steroidal anti-inflammatory drugs. Some 11.0% (33/299) of injuries were lacerations, and a low threshold for suture as a means of primary closure was adopted, particularly in cold or wet conditions. One case of division of the finger extensor tendon was managed by primary suture and wound closure. Damage to cartilage, ligament, or tendon made up 9% (27/299) of injuries; these were dominated by ligament problems, which were immobilised when severe.

Head injuries were relatively common (20/299, 6.7%), but no loss of consciousness was documented. Some 8.4% (25/299) of injuries fell into the miscellaneous category consisting of foreign body (3/299), dislocation (3/299), blunt abdominal trauma (1/299), effusion/bursitis (11/299), and crush injuries (7/299). Three cases of olecranon bursitis were described, which were treated with early aspiration, compression, and early introduction of oral broad spectrum antibiotics. Figure 2 gives a breakdown of injuries according to anatomical location.

Illnesses on board
Illnesses of various types accounted for 56.4% of all cases (386/685). Figure 3 illustrates the breakdown of illnesses by type. Eighty seven cases (22.5%) of disorders of the gastrointestinal or renal tract were documented, including three surgical emergencies which were all evacuated during the race. The three surgical emergencies evacuated were a case

### Table 1 Medical exclusions based on information gathered from the questionnaire completed before the race

<table>
<thead>
<tr>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ischaemic heart disease, bypass grafting or angioplasty</td>
</tr>
<tr>
<td>Symptomatic bronchial asthma</td>
</tr>
<tr>
<td>Long term medication such as warfarin</td>
</tr>
<tr>
<td>Single kidney and transplant recipients</td>
</tr>
<tr>
<td>Colostomy or ileostomy</td>
</tr>
<tr>
<td>Active malignancy</td>
</tr>
<tr>
<td>Progressive neurological disease</td>
</tr>
<tr>
<td>Psychiatric disease</td>
</tr>
<tr>
<td>Insulin dependent diabetes</td>
</tr>
<tr>
<td>Pregnancy</td>
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</table>

### Table 2 Breakdown of all medical cases in BT Global Challenge Race 1996–1997

<table>
<thead>
<tr>
<th>Yacht name</th>
<th>Neuro/renal</th>
<th>GI/renal</th>
<th>Flu/ENT</th>
<th>Resp</th>
<th>Derm./Abscess</th>
<th>Sepsis/Septic</th>
<th>Hypotherm</th>
<th>Trauma</th>
<th>Psych</th>
<th>Other</th>
<th>Dental</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>Motorola</td>
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<td>0</td>
<td>19</td>
<td>0</td>
<td>16</td>
<td>11</td>
<td>34</td>
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<td>4</td>
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<tr>
<td>Group 4</td>
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<td>0</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>2</td>
<td>0</td>
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<td>1</td>
<td>5</td>
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<td>20</td>
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<td>0</td>
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<td>8</td>
<td>10</td>
<td>15</td>
<td>21</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>76</td>
<td>103</td>
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<td>Concert</td>
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<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>0</td>
<td>1</td>
<td>0</td>
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<td>Courtaulds</td>
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<td>2</td>
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<td>3</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>19</td>
<td>19</td>
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<td>0</td>
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<td>0</td>
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<tr>
<td>Health</td>
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<td>1</td>
<td>4</td>
<td>5</td>
<td>3</td>
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<td>25</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>41</td>
<td>53</td>
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<tr>
<td>Time + Tide</td>
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<td>1</td>
<td>7</td>
<td>8</td>
<td>11</td>
<td>10</td>
<td>55</td>
<td>0</td>
<td>10</td>
<td>4</td>
<td>106</td>
<td>146</td>
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<td>16</td>
<td>11</td>
<td>8</td>
<td>38</td>
<td>0</td>
<td>9</td>
<td>1</td>
<td>23</td>
<td>299</td>
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<td>1</td>
<td>1</td>
<td>14</td>
<td>9</td>
<td>1</td>
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<td>6</td>
<td>5</td>
<td>17</td>
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<td>36</td>
<td>38</td>
<td>38</td>
</tr>
<tr>
<td>Rover</td>
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<td>4</td>
<td>6</td>
<td>4</td>
<td>6</td>
<td>1</td>
<td>18</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>41</td>
<td>41</td>
</tr>
<tr>
<td>Global T</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>13</td>
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<td>0</td>
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<td>58</td>
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<tr>
<td>Total</td>
<td>17</td>
<td>14</td>
<td>87</td>
<td>73</td>
<td>82</td>
<td>60</td>
<td>299</td>
<td>1</td>
<td>36</td>
<td>16</td>
<td>685</td>
<td>299</td>
</tr>
<tr>
<td>Mean</td>
<td>1.21</td>
<td>1.00</td>
<td>6.21</td>
<td>5.21</td>
<td>5.86</td>
<td>4.29</td>
<td>21.36</td>
<td>0.07</td>
<td>2.57</td>
<td>1.14</td>
<td>48.93</td>
<td>16</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>1.89</td>
<td>1.18</td>
<td>6.05</td>
<td>3.96</td>
<td>4.62</td>
<td>4.98</td>
<td>13.99</td>
<td>0.28</td>
<td>3.37</td>
<td>1.50</td>
<td>31.78</td>
<td></td>
</tr>
</tbody>
</table>

- Neuro, Neurological disorder; Ophth, ophthalamic disorder; GI, gastrointestinal; ENT, ear, nose and throat; Resp, respiratory disorder; Derm, skin disorder; Abscess, Hemorrhage/haemorrhia; Psych, psychological disorder.
- Yachts: PTR, Pause to Remember; Courtaulds, Courtaulds International; Nuclear, Nuclear Electric; Heath, Heath Insured; STC, Save the Children; Comm Union, Commercial Union; Rover, Ocean Rover; Global T, Global Teamwork.
of haematuria (no follow up information available), malaena stool with past history of peptic ulceration (active ulceration and bleeding not confirmed endoscopically), and acute appendicitis (subsequently confirmed and appendix removed). More than half (44; 51%) of the cases were gastroenteritis, which included one cluster. There were 21 (24%) cases of dyspepsia/gastritis, which were all managed with oral alkaline suspensions and/or ranitidine. In addition, there were nine (10%) cases of constipation, four (5%) of perianal pain/haemorrhoids, two urinary tract infections, two inguinal hernias, one complication of previous abdominal surgery, and one case of non-specific abdominal pain.

Dermatological conditions comprised 21.2% (82/386) of medical cases at sea. The case mix within this category included boils, “gunwale” bottom, and eczema; all were treated with basic hygiene methods (often lacking on boats), oral antibiotics, and/or topical steroid ointment.

Seventy three (18.9%) ENT/flu/respiratory cases were recorded, 51 of which were upper respiratory tract infections. Additional cases included middle ear infection and earwax. A case of suspected spontaneous pneumothorax was diagnosed by a doctor in a tall thin man aged 25 years with a past history of a small (<20%) pneumothorax; he was carefully observed and conservatively managed. Subsequent chest radiograph showed no residual collapse.

Seasickness accounted for 60 (15.5%) cases and was probably underestimated where mild symptoms were unreported or where such an affliction was not deemed a medical case. Broad ranges of antiemetics were used in prophylaxis and treatment, and were minimally effective. No cases of significant hypothermia were recorded.

Neurological problems (17; 4.4%) were predominated by headaches, including migraine, one posterior interosseus nerve lesion following a contusion from a flogging sheet while

Table 3  Injuries and illnesses in Whitbread Round the World Yacht Race 1997–1998

<table>
<thead>
<tr>
<th>Injuries</th>
<th>Number of cases</th>
<th>%</th>
<th>Illnesses</th>
<th>Number of cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervical pain</td>
<td>31</td>
<td>14.2</td>
<td>Cracked skin</td>
<td>63</td>
<td>31.2</td>
</tr>
<tr>
<td>Low back pain</td>
<td>51</td>
<td>23.4</td>
<td>Gunwhale bum</td>
<td>50</td>
<td>24.8</td>
</tr>
<tr>
<td>Shoulder pain</td>
<td>37</td>
<td>17.0</td>
<td>Infected skin sores</td>
<td>14</td>
<td>6.9</td>
</tr>
<tr>
<td>Lateral epicondylitis</td>
<td>14</td>
<td>6.4</td>
<td>Fungal rash</td>
<td>35</td>
<td>17.3</td>
</tr>
<tr>
<td>Medial epicondylitis</td>
<td>16</td>
<td>7.3</td>
<td>Frost bite</td>
<td>14</td>
<td>6.9</td>
</tr>
<tr>
<td>Wrist pain</td>
<td>37</td>
<td>17.0</td>
<td>Burns</td>
<td>10</td>
<td>5.0</td>
</tr>
<tr>
<td>Anterior knee pain</td>
<td>13</td>
<td>6.0</td>
<td>Dental</td>
<td>10</td>
<td>5.0</td>
</tr>
<tr>
<td>Ankle/foot pain</td>
<td>19</td>
<td>8.7</td>
<td>Ear infections</td>
<td>6</td>
<td>3.0</td>
</tr>
<tr>
<td>Total</td>
<td>218</td>
<td></td>
<td></td>
<td>202</td>
<td></td>
</tr>
</tbody>
</table>

Taken from Spalding T and Rodrigues R 2001.

![Figure 1](image1.png)  
**Figure 1** Subtype of injuries as a proportion of total injuries sustained throughout the British Telecom Global Challenge 1996–1997.

![Figure 2](image2.png)  
**Figure 2** Breakdown of injuries according to anatomical region as a proportion of total injuries sustained throughout the British Telecom Global Challenge 1996–1997.
tacking (this patient was unable to complete the race), and one case of benign positional vertigo following head injury. One collapse of unknown cause was documented and subsequently diagnosed several months later as intracerebral pathology. One psychiatric case of “deck fright” following a heavy storm in the Southern Ocean, characterised by fear of being on deck especially at night, was treated with a short course of diazepam 5 mg three times a day and gradual lowering of anxiety during the course of the race.

Dental problems accounted for 16 (4.1%) illnesses, of which 12 were related to gingivitis or decay, treated with analgesia and broad spectrum oral antibiotics. Four dental injuries were temporarily repaired using filler. Fourteen (3.6%) ophthalmic complications were described, of which nine were infectious conjunctivitis, three related directly to contact lenses, two were dry eyes, and one stye. No corneal abrasions were described despite conditions in the Southern Ocean that would predispose to this. Anecdotical reports of sore eyes caused by high velocity salt spray, particularly while helming, were, however, common. No foreign body was observed. Chloramphenicol was the drug most often used for infectious conjunctivitis.

The remaining 36 (9.3%) miscellaneous cases reported included malignant melanoma, idiopathic oedema, drug reaction, phlebitis, and four amputation stump/sinus infections on T&T.

**DISCUSSION**

The results set out the incidence of both injuries and illnesses encountered at sea on an amateur yacht race in which about six months were spent at sea. No deaths were recorded, which, in the context of duration and weather conditions encountered, indicated a level of commitment to safety from both organisers and crew. Despite three evacuations, most cases arising at sea were treated and managed at sea. Two of the three evacuations were necessary because of undisclosed circumstances in the Southern Ocean that would predispose to this. Anecdotical reports of sore eyes caused by high velocity salt spray, particularly while helming, were, however, common. No foreign body was observed. Chloramphenicol was the drug most often used for infectious conjunctivitis.

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reports from the crew suggested that, although such equipment may have provided considerable protection from prevailing elements, it may be insufficient to maintain dryness in heavy weather, in particular on the foredeck. Unconfirmed observations suggest that a roughly equal numbers of injuries were reported in the cockpit and on the foredeck. In particular, helmsmen are exposed to high speed volumes of spray in the Southern Ocean, which may have accounted for a large proportion of injuries. Those on the foredeck were prone to injury, particularly when large waves broke over this area, although overall injury incidence was increased in the rougher weather legs. With the available data, clear relations between injury and type of activity or skipper personality cannot be established.

On comparison with the professional Whitbread Round the World Yacht Race 1997–1998 (table 3), some clear differences may be observed. Fewer serious injuries were reported, but a high proportion of minor injuries were observed. In particular, a high incidence of shoulder and cervical pain was common in helmsmen, which could have been remedied, in part, by retraining. Such differences in figures between professional and amateur yacht races may be accounted for by enhanced balance, optimal physical fitness, and sharper instinctive type reflexes.

Gastrointestinal ailments formed the largest group of illnesses, although in this study seasickness was considered separately. A quarter (24.5%) of cases were gastrointestinal, and this was one of the most common reasons for landing patients.4 In our study, non-steroidal anti-inflammatory drugs may have contributed to this, prompting the suggested use of more selective cyclo-oxygenase type (COX2) inhibitors. An outbreak of gastroenteritis simultaneously affecting multiple crew members occurred in one yacht, and may have been caused by the water supply. Skin conditions were also common, probably as a result of a combination of heat, damp, salt encrustation (in particular relating to wrist and neck seals on dry suits), and oilsink chaffing. Lack of fresh water facilities (one shower a week), crowding, and lack of personal hygiene were contributory factors. Gynaecological problems were on the whole unreported, for which there may be a number of reasons. A proportion of the female crew opted for continuous use of the combined oral contraceptive pill, evidencing that amenorrhoeic for each leg of the race. In addition, female crew members may have been reluctant to consider this. We observed that acclimatisation to motion appears to have contributed to this, prompting the suggested use of more selective cyclo-oxygenase type (COX2) inhibitors.

Illness and injury in amateur ocean yacht racing 461
Take home message
Medical problems aboard yachts in amateur ocean races are relatively common. Most can be dealt with on board, provided that crew medics are adequately trained and that essential equipment, communication, and training, and equipment are provided and maintained. Further research is required to establish optimal medical requirements for ocean based yachting.

In summary, although a lot of cases have been reported in this race, a large proportion of which involved injury, such an event can take place with relative safety provided that training and commitment on behalf of organisers, skippers, and individual crew volunteers remain a priority. Important components of this include appropriate medical equipment and training and a need for continual development and discussion. We note in particular the relative lack of attention to such areas as nutrition and appropriate medical screening before the race. Furthermore, there is a need for all medics, medically qualified or otherwise, to be trained in basic life support18 and the management of trauma to Advanced Trauma Life Support (ATLS) standard.19 The scope of such training should be a subject for future research and debate.

We acknowledge all those for their assistance in carrying out the present study to press: Dr S Briggs, Dr Affrastah, Dr S Bryce, Dr S Hughes, Dr M Simmons, Dr J Scott, Rosemary Lindon, Andrea Carter, Leslie Bowden, Margot Douglas, Sally Stewart, Valerie Bell, Helen Bentley, Eleanor Pinto at the Cambridge University Centre for Applied Statistics, Sir Chay Blyth, and The Challenge Business.

APPENDIX A
Medical kit provided for each yacht on the British Telecom Global Challenge 1996/7
Skin preparations:
Calamine lotion, E45 cream, Flamazine, hydrocortisone 0.5%, ketoknarin, KY jelly, magnesium sulphate, stercz powder, iodine.

In all efficacious. A formal relation between seasickness and injury remains unestablished.

Although “down time” is usually a term used for sails, it also applies to crew and some were “off watch” for as long as 21 days. This places added strain on the fit members which may result in fatigue and ultimately exhaustion. This may be particularly relevant in heavy weather. Information with respect to watch systems run by individual skippers was closely guarded, although it is clear that watches at night in heavier weather legs were generally shorter. Stampi16 has recently studied sleep patterns observing the time honoured technique of “cat napping”. Given its potential to cause accident and loss at sea, it is appropriate that the International Maritime Organisation should include fatigue as a topic for further investigation, and this is increasingly recognised. Psychological cases were rare, hence it is not possible to draw conclusions about how such illnesses correlate with factors such as weather, personality, or the presence of a sympathetic medic. However, we do acknowledge that certain symptoms such as fatigue may be a manifestation of psychosomatic illness and that, in contrast with professional sailors, amateur crew members may have had differing attitudes and responses to certain situations at sea.

The medical equipment provided by the race organisers was adequate but continues to undergo constant development and updating for subsequent races. These kits were based on the statutory requirements of the Maritime and Coastguard Agency from the Merchant Shipping Notice (MSN 1726). Each yacht was supplied with category A kit (appendix A) with certain modifications, although cylinder oxygen was not carried. In future races, consideration will be given to molecular sieve converters. In view of the sophisticated board communications systems available, the role of telemedicine facilities may also be considered. We support the use of this technology and acknowledge its advantages, but accept that it cannot replace a well trained medic with a comprehensive medical kit.

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REFERENCES


The authors are to be commended for a prospective study of the medical problems arising on a very long, albeit in stages, ocean race. They rightly make the point that such racing is no longer the preserve of the young fit professional (the oldest subject in the study was aged 60), and thus the conditions they report have moved towards those seen among merchant seamen, rather than young athletes. This paper should be consulted by all planning or participating as a medic in ocean racing at whatever level, to inform decisions on equipment and medical stores, and is thus a useful contribution to the literature.

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