OPEN ACCESS

Epidemiology and impact of travellers' diarrhoea differs during UK military training exercises in Kenya and Oman

Romeo Toriro ,[1,2] B Tabberer,[3] S I Davis,[4] N L Reece,[5] S D Woolley ,[2,5] M K O'Shea ,[5,6] T E Fletcher,[2] D S Burns,[1] N J Beeching[2]

► Additional supplemental material is published online only. To view, please visit the journal online (https://doi.org/10.1136/military-2024-002913).

[1]Royal Centre for Defence Medicine, Birmingham, UK
[2]Department of Clinical Sciences, Liverpool School of Tropical Medicine, Liverpool, UK
[3]University of Nottingham, Nottingham, UK
[4]Defence Medical Rehabilitation Centre, Loughborough, UK
[5]Centre for Defence Pathology, Royal Centre for Defence Medicine, Birmingham, UK
[6]College of Medical and Dental Sciences, University of Birmingham, Birmingham, UK

Correspondence to
Romeo Toriro; Romeo.Toriro@lstmed.ac.uk

Received 25 October 2024
Accepted 12 January 2025

Check for updates

To cite: Toriro R, Tabberer B, Davis SI, *et al*. *BMJ Mil Health* Epub ahead of print: [*please include* Day Month Year]. doi:10.1136/military-2024-002913

ABSTRACT

Background Gastrointestinal illnesses are common during military training and operational deployments. We compared the incidence and burden of travellers' diarrhoea (TD) reported by British service personnel (SP) during recent training exercises in Kenya and Oman.

Methods SP completed a validated anonymous questionnaire regarding clinical features of any diarrhoeal illness, associated risk factors and impact on work capability after 6-week training exercises in 2018 in Kenya and 2018–2019 in Oman. Responses were tabulated for descriptive comparisons.

Results Questionnaires were received from 388 (32%) SP in Kenya and 627 (52%) in Oman. The cumulative incidence of reported diarrhoea over 6-weeks was 14.2% (95% CI 8.02% to 22.61%) in Kenya compared with 3.9% (95% CI 1.10% to 9.91%) in Oman (OR 3.56, 95% CI 2.18 to 5.8; p<0.0001). Attack rates were 9.45 SP/100 exposure-months in Kenya and 2.66/100 in Oman. The number of workdays lost was greater in Kenya (6.26 per 1000 days) compared with Oman (4.13 per 1000 days) (p<0.01). In Kenya, 52.3% of those experiencing diarrhoea became ill during the first 14 days of deployment, but in Oman, 50% were ill in the last deployment week. The strongest risk factor associated with TD at both locations was contact with a colleague experiencing diarrhoea, followed in Kenya by eating locally sourced food and swimming in local water, which had weaker protective associations in Oman.

Conclusions The epidemiology, risk factors and burden of TD in Kenya were similar to previous descriptions, where overall incidence continues to decline. Incidence and burden were significantly lower in Oman, where both were much lower than historical descriptions. Peak timing of illness and associated risk factors differed between Kenya and Oman. Continued documentation and review of TD during training exercises at different geographical locations is essential to inform the chain of command about risks to operational effectiveness.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Diarrhoeal illnesses are among the most common travel-related causes of infection and consistently rank in the top third of disease non-battle injury aetiologies in military deployments.

WHAT THIS STUDY ADDS

⇒ Data on travellers' diarrhoea (TD) in British military training exercises are scarce, but available data from Kenya show a decline in burden, although the incidence remains almost four times greater than in Oman.

⇒ TD poses an important threat to operational effectiveness during military training deployments, and close contact with an unwell colleague is the most significant risk factor, highlighting the need for improved force health protection measures.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Sustained surveillance of TD trends in all deployment locations is necessary to inform the chain of command responses, including allocation of resources such as molecular diagnostics, and advice for improved reporting and early self-management.

BACKGROUND

Travellers' diarrhoea (TD) is frequently the most common travel-related illness, affecting 30%–70% of travellers.[1] Its aetiology varies by region, season, duration and style of travel, individual traveller health status, eating habits and other behavioural factors.[1 2] In addition to disruption of travel plans in about 40% of cases, TD can cause more severe symptoms and subsequent functional bowel disorders, reactive arthritis and rare sequelae such as Guillain-Barré syndrome.[3–5] Gastrointestinal (GI) illnesses have always posed a significant risk to military operations and continue to be among the most common disease non-battle injury (DNBI) aetiologies recorded in military deployments.[2 6–10]

TD is usually defined as the passage of three or more unformed stools in 24 hours, or two or more stools accompanied by at least one of: fever ≥37.8°C, nausea, vomiting, abdominal cramps, tenesmus or blood in the faeces.[1 2 11] Severity of illness can be classified on a physiological basis using measures such as stool frequency, the presence of blood in faeces, high fever and duration of illness or on a functional basis according to the effects on daily activities.[1] In the military, TD is typically classed by functional impact rather than the conventional frequency algorithm. The following recommended descriptors are used: mild illness—minimal or no change in function; moderate to severe illness—ranging from reduced to completely unable to function and febrile diarrhoea.[9] Timely and effective treatment of TD could result in a 50%–70% reduction in illness duration and loss of effective workforce days.[9]

British military populations deploy globally to areas in Africa, South-East Asia, Central America and adjacent regions of South America with a higher risk (≥20%) of acquiring TD.[2 7 10] Close living conditions for large numbers of personnel in barracks, field hospitals or ships also facilitate the rapid spread of noroviruses and similar viral outbreaks.[5 10 12–14] Previous UK operational data from two Afghanistan 6-month tours show that ~40% of troops questioned reported at least one diarrhoeal illness episode,[15] and that infectious diarrhoea was the second most common reason for field hospital admittance from 2005 to 2013.[16] Diarrhoeal diseases were the most common diagnoses and reason for admittance to a UK field hospital (12.60% of 1368 service personnel from 14 allied countries), resulting in medical evacuations back to the UK.[17] Similar findings have been documented in the US military.[12 13 18 19] The clinical management of TD is usually syndromic in the absence of forward diagnostics.

Reports from trials of treatment and prevention of GI illnesses in Kenya have suggested a decrease in incidence of TD in the British Army Training Unit Kenya (BATUK) over time. Unpublished data show cumulative incidence rates of between 40% and 60% from 1997 to 2000.[10] Subsequent reports have shown a marked reduction in overall cumulative incidence to 21.9% over 6 weeks in 2014[11] and 14.3% over 10 weeks in 2022.[20] Oman also hosts frequent UK military training deployments, and the limited available data from over 20 years ago showed that medical presentations, especially GI illnesses greatly outnumbered injuries sustained in combat.[21 22] A recent report outlining the mitigatory effects of infection prevention and control (IPC) expertise during the Oman deployments cites unpublished post-exercise reports from the same site 20 years ago describing discrete point source TD outbreaks.[23] This matches the historical reports we referred to earlier.[21 22]

The British military continues to undertake training in Oman and Kenya and understanding the burden of TD allows planning for interventional prevention studies, informs commanders of the impact on force health protection (FHP) and allows trends in time and space to be understood. We compared the incidence and outcomes of TD in British military personnel during training deployments to Kenya in 2018, and Oman in 2019.

METHODS

All British military personnel deployed for training exercises in Kenya in spring 2018, and Oman in winter 2018 and spring 2019, were eligible to take part. Complete descriptions of sites including timelines, infrastructure, medical capability and general deployment conditions are detailed in online supplemental Data Sheet 1.

A previously validated self-assessed GI health data questionnaire[11] was distributed at the point of departure following 6 weeks of training from both countries as part of routine public health surveillance (online supplemental Data Sheet 2). Questionnaires were completed by respondents without individual supervision and were returned to the UK by investigators and secured in approved storage pending data analysis. No personally identifiable data were collected from any of the respondents. The questionnaire included 28 questions with some free text options. Information collected included demographics, the number of discrete diarrhoeal episodes experienced during each deployment, the number of bowel movements per episode, other illness characteristics, illness duration, days off work, the impact of illness on work performance measured according to functional impact[9] and potential risk factors for TD.

Data were collated in Microsoft Excel and manually cleaned before removal of duplicate entries and descriptive tabulations. After further checks, incomplete data were excluded from analyses of answers to individual questions. Data from the two Oman exercise sites were combined for comparison with the combined exercises in BATUK, Kenya. Cumulative incidence during the 6 weeks was calculated as the total number of TD cases divided by the number of respondents. The burden of TD was described as days hospitalised (bedded down) or underperforming, and a combination of both. Workforce days affected by underperformance were calculated as a total number of days of functional impairment by all respondents divided by the total number of deployment days. Total workforce days at risk were estimated for those responding to the questionnaire at each location, multiplied by 42 days of deployment each. These were used to define the burden of TD as a percentage of deployment days lost or as days lost per 1000 days of deployment. Univariate statistical comparisons were performed using IBM SPSS Statistics V.29. Participation was voluntary and the study did not require (redacted for peer review) approval in line with the extant guidance at the time.

RESULTS

The population at risk (PAR) was ~1200 individuals at each exercise location. 388 SP (32.3%) returned questionnaires after training in Kenya and 627 (52.3%) after training in Oman. The majority were young men in the lower ranks (79.1% in Kenya and 72.3% in Oman) (Table 1). TD was reported by 14.2% of SP in Kenya which was significantly more than 3.9% of those in Oman (OR 3.56, 95% CI 2.18 to 5.8; p<0.0001). This corresponds to 9.45 SP/100 exposure-months in Kenya and 2.66 in Oman (Table 1). There was no significant difference in rates of admission of those with TD to a medical facility in Kenya, compared with Oman (15/55 (27.3%) vs 11/25 (40%); p=0.14). The total number of workdays lost was significantly greater (p=0.0029) in Kenya (6.26 per 1000 days) compared with Oman (4.13 per 1000 days), mainly due to a greater proportion of days underperforming (Table 1).

Responses to questions about timing of onset, symptoms and TD treatment are summarised in Table 2. In Kenya, 52.3% SP first experienced diarrhoea within 2 weeks of arrival, but in Oman, 50% became ill during or after the last week of the 6-week deployment. Just over half of all respondents reported multiple episodes of diarrhoea. Abdominal pain and cramp were reported by >85% of all respondents at each location, and there was a trend of increased antibiotic treatment in Oman. In Oman, 10/25 (40%) of respondents with diarrhoea also reported chronic bowel problems prior to travel compared with 2/55 (3.6%) in Kenya. 1/25 (4%) reported a confirmed irritable bowel syndrome diagnosis in the Oman cohort vs 1/55 (1.8%) in the Kenya cohort (data not shown).

Key risk factors for developing TD at each location are summarised in Table 3. There was no association with rank, gender or source of drinking water at either location. The strongest association with TD at both locations was having contact with a colleague who had diarrhoea, followed in Kenya by eating locally sourced food and swimming in local water. Conversely, personnel in Oman with diarrhoea were less likely to have eaten locally sourced food and less likely to have swum in local water.

Table 1 Demographic features of UK service personnel including the incidence and outcomes of diarrhoeal episodes during 6-week (42 days or 1.5 months) training exercises in Kenya in 2018 and Oman in 2018 and 2019

	Kenya N=1200			Oman N=1200		ORs (95% CIs)	P value
	n/N		%	n/N	%		
Total respondents	388			627			
Median age group (year range)	20–25			26–30			
Male	313		80.7	519	82.8	0.97 (0.807 to 1.177)	0.79
Other ranks	307		79.1	453	72.3	1.10 (0.904 to 1.328)	0.35
Reported diarrhoea (95% CI)	55		14.2 (8.02% to 22.61%)	25	3.9 (1.10% to 9.91%)	3.56 (2.179 to 5.80)	<0.0001
SP with diarrhoea/100 exposure-months (95% CI)	9.45 (6.73% to 12.81%)			2.66 (1.55% to 4.24%)		3.56 (2.179 to 5.80)	<0.0001
Bedded down in medical facility due to diarrhoea	15/55		27.30	11/25	40	0.477 (0.178 to 1.282)	0.14
Burden on exercise (42 days per person)	**n**	**%**	**Per 1000 days**	**n**			
Admitted to medical facility	15	3.90		11	2.29 (1.042 to 5.043)		0.039
Workforce days sick in quarters	51	0.313	3.13	75.50	1.12 (0.783 to 1.597)		0.59
Workforce days underperforming	51	0.313	3.13	35	2.40 (1.558 to 3.686)		0.0001
Total workdays affected	102	0.626	6.26	110.5	1.51 (1.152 to 1.980)		0.0029

North Atlantic Treat Organisation (NATO) rank ranges; Other ranks=OR (OR1–OR4).
SP, service personnel.

DISCUSSION

This is the first detailed report of TD during overseas training deployments of British SP to Oman. We found that 3.9% of SP experienced diarrhoeal illnesses over a total of 6 weeks in winter 2018 and spring 2019, considerably lower than the 14.2% affected in rural Kenya in spring 2018. The incidence in Kenya is similar to the 14.3% incidence observed at the same location over a 69-day period in early 2022 in a PAR of ~1200 individuals, during which a point source outbreak of cryptosporidiosis was implicated in 59.4% of the cases.[20] The risk associated with swimming in local water sources in Kenya was emphasised again in 2022; local river water and recreational swimming pools were shown to be heavily contaminated with faecal coliforms and were implicated as the sources of a large outbreak of cryptosporidiosis.[20] Eating local food, especially during field training, was also linked with diarrhoeal illness caused by other pathogens during the same training deployment.[20]

Many of the findings from Oman were similar, but the decreased incidence of diarrhoea was substantially lower than historical reports from the same region, where cumulative incidences of 28% (12.1 episodes (95% CI 11.4 to 12.7) per 100 person-months) were reported between April 2006 and March 2007 during operational deployments to Iraq.[24] Apart from differences in geographical location, Kenya and Oman have noticeable infrastructural and economic differences. Other studies have highlighted the high incidence of TD during operational and training deployments in Africa.[2 25 26] The lower incidence of TD in Oman would be expected, as it is a high-income country with a lower overall risk than Kenya. The accommodation, ablution facilities and maintenance of recreational swimming pools in recommended hotels were of higher standards for SP using these facilities in Oman than in Kenya. This may underlie the negative association of eating locally sourced food with diarrhoeal illness and the weak negative association in univariate analysis between swimming in local water and diarrhoeal illness.

The late timing of the first onset of TD differed at both locations but was unexpected in Oman. Although the number of affected SP was small, the data suggested a small point source outbreak towards the end of the training exercise. This is consistent with the previous report of a small diarrhoeal outbreak affecting nine people at Camp Shafa, attributed to enterotoxigenic *Escherichia coli* in the five cases tested with onsite molecular diagnostics.[23] In Kenya, the majority of cases were affected during the first 2 weeks of arrival, which is typical of TD in most civilian and military settings.[1 2 5 27] This was also seen in the previous questionnaire study at this site in 2014 where similar risk factors were reported, although the incidence was higher at 21.9%.[11] The most common associated risk factor at both locations was contact with an unwell colleague; however, the strong associations with swimming in local water or eating local food in Kenya were not mirrored in Oman, where there were much weaker associations with these activities. There was a trend towards more severe illness in Oman, with more of those with diarrhoea receiving antibiotics and/or being admitted for treatment at a deployed treatment facility that was in close proximity to the exercising troops. A similar facility was only available at the main operating base in Kenya. Without specific information from medical notes or any diagnostic data, any explanation remains anecdotal.

Experience during military deployments elsewhere has highlighted the impact of functional impairment on operational commitments.[2 5] Examining the timing of illness episodes is valuable; for example, 14.2% of personnel experienced TD over a 6-week period in Kenya, with 0.63% of working days lost overall. However, 40.9% of this occurred during the first week of training meaning 5.8% of all personnel were bedded down or underperforming during the first week of training. These numbers, which reflect general experience with TD worldwide, are sufficient to impact operational effectiveness early in deployments, whether for training or other purposes. There are increasing Defence Engagement programmes including short-term training team (STTT) missions to Africa, Asia and the Middle East, highlighting the DNBI risk, particularly from enteric illnesses which are in the top third of common medical presentations during British and other military deployments.[2 16 17 26 28] Training deployments to Oman and Kenya are long-standing and benefit from enduring environmental health

Table 2 Clinical features of diarrhoea recalled by service personnel after 6-week training deployments to Kenya in 2018 and Oman in 2018 and 2019

	Kenya (N=55) n/N (%)	Oman (N=25) n/N (%)
Week after arrival of onset of first diarrhoea episode		
1	18/44 (40.9)	5/24 (20.8)
2	5/44 (11.4)	1/24 (4.2)
3	4/44 (9.1)	1/24 (4.2)
4	5/44 (11.4)	3/24 (12.5)
5	5/44 (11.4)	2/24 (8.3)
≥6	7/44 (15.9)	12/24 (50)
Missing data	11 (20)	1 (4)
Number of diarrhoeal episodes		
1	34/50 (68)	10/23 (43.5)
2	12/50 (24)	6/23 (26.1)
≥3	4/50 (8)	7/23 (30.4)
Missing data	5 (9.1)	2 (8)
Duration (days)		
1	17/51 (33.3)	10/25 (40)
2–3	20/51 (39.2)	9/25 (36)
4–5	9/51 (17.6)	4/25 (16)
>5	5/51 (9.8)	2/25 (8)
Missing data	4 (7.3)	0
Number of bowel movements per day		
Up to 2	0	8/25 (32)
3–5	39/49 (79.6)	10/25 (40)
≥6	10/49 (20.4)	7/25 (28)
Missing data	6 (11)	0
Symptoms		
Fever	8/21 (38.1)	4/7 (57.1)
Abdominal pain/cramps	27/34 (79.4)	18/19 (94.7)
Nausea	7/22 (31.8)	9/10 (90)
Vomiting	3/19 (15.8)	3/4 (75)
Joint pain	5/20 (25)	4/5 (80)
Muscle aches	7/20 (35)	6/6 (100)
Blood in diarrhoea	3/52 (5.8)	4/6 (66.7)
Diarrhoea management		
Prescribed antibiotics	6/12 (50)	7/52 (13.5)

cadre support in terms of food and water sourcing, as well as local monitoring of health practices and standards in recreational and eating establishments recommended to SP. This also applies to activities undertaken during adventure training opportunities and stand-down periods. STTTs lack adequate medical capability which might lead to dependence on local health support. Due to the lack of such routine support as would be provided for larger-scale deployments, higher TD rates might be expected.

Mitigatory measures including self-treatment could help minimise the risk for chronic health sequelae, particularly in remote deployment locations with inadequate medical cover.[1 2] The downward trend in incidence of TD over the past two decades in Kenya might be attributed to improved infection control practices, including robust handwashing routines observed in both Kenya and Oman deployments. Routine enforcement of FHP measures should involve more vigorous and targeted dissemination of information including details and set up of isolation facilities, with concurrent initiation of other practices that influence overall population hygiene. Specialist IPC capability was absent in Kenya but present in Oman and could have been instrumental as a mitigatory measure in TD management at that location. The effectiveness of culture-independent testing for TD aetiology as a control strategy has previously been demonstrated in austere environment settings[20 29] and current guidelines support this.[9] However, such molecular diagnostic capability was only available in Oman and would have had to be outsourced from local preapproved medical facilities when required in Kenya. Monitoring of the established training sites in Kenya and Oman shows that risks appear to be reducing over time. Nonetheless, we suggest that in addition to re-enforcing the implementation of isolation measures, other FHP initiatives should include improving advice on minimising contact with other SP with diarrhoea, which had a greater associated risk.

Several shortcomings need to be considered when evaluating the data presented here. Seasonal variations are known to influence the incidence of TD[28] but were not explored. There were insufficient data for multiple regression analysis as performed in the previous Kenya study, where close contact with an unwell colleague, swimming in local water or eating local food was significantly associated with diarrhoeal illness.[11] The questionnaires were completed at the end of a 6-week training tour; therefore, there is a possibility of recall bias. Due to the confidential nature of the study, questionnaires could not be checked for completeness, and some were later found to be missing answers to individual questions. The possibility of transcription errors should also be considered as only paper-based questionnaires were used. Only a third of eligible personnel training in Kenya and half of those in Oman completed questionnaires, with possible positive recruitment bias in favour of those who experienced diarrhoea. Similar questionnaire studies elsewhere have underestimated the true incidence of diarrhoeal illness, possibly due to reluctance to report milder, self-treated episodes of TD.[10] Conversely, other reports show substantially higher rates of TD when self-reported by SP compared with rates derived from healthcare attendance records.[30] Similar limitations applied to the questionnaire study 4 years earlier in BATUK, which had an estimated response rate of 41%.[11] In that study, the cumulative incidence of diarrhoeal episodes was 21.9% of SP in a 6-week period.

Comparability of data derived from different sources would be improved by adoption of standard reporting of outcomes. Previous studies have described incidence of diarrhoea in terms of cumulative incidence during a whole deployment period,[11] or period incidence per 100 or 1000 exposure-weeks[25 28] or exposure-months.[2 18 19] The effects of this on operational effectiveness are better described by enumerating the number of personnel days lost to bedding down and underperformance[2]; in the absence of standardisation, we have expressed this both as overall percentages and as days lost per 1000 exposure days. This showed that, although the proportion of personnel affected by TD was much lower in Oman compared with Kenya, the difference in proportional days lost in Oman was smaller as individuals with TD were more severely affected there than in Kenya. As emphasised 20 years ago, healthcare providers have a responsibility to document healthcare usage during deployments in order to inform future operational planning and mitigation measures.[21] Future studies should incorporate a combination of data collected prospectively regarding healthcare usage including from medical records, combined with exit questionnaires as used in our study, and more accurate daily or weekly enumeration of persons at risk should be conducted.

CONCLUSIONS

Most studies on TD in the military have focused on operational deployments. This study adds to the sparse literature

Table 3 Risk factors for diarrhoea among UK service personnel during 6-week training exercises in Kenya in 2018 and Oman in 2018 and 2019

	Kenya				Oman			
Potential risk factors for diarrhoea	**n/N (%)**	**OR**	**95% CI**	**P value**	**n/N (%)**	**OR**	**95% CI**	**P value**
Military rank								
Other ranks	42/307 (13.7)	0.852	0.437 to 1.663	0.6397	14/453 (3.1)	0.480	0.214 to 1.079	0.076
SNCOs and officers	13/81 (16.0)				11/171 (6.4)			
Gender								
Male	40/313(12.8)	0.652	0.307 to 1.385	0.2655	18/519 (3.5)	0.502	0.194 to 1.302	0.16
Female	10/51 (19.6)				6/87 (6.9)			
Drank local water								
Yes	1/9 (11.1)	0.688	0.085 to 5.544	0.7254	3/37 (8.1)	2.31	0.657 to 8.132	0.19
No	52/322 (16.1)				20/570 (3.5)			
Incomplete data	2/57 (3.5)				2/20 (10)			
Ate local food								
Yes	19/34 (55.9)	7.95	3.802 to 16.613	<0.0001	5/298 (1.7)	0.269	0.099 to 0.731	0.01
No	18/256 (7.03)				19/305 (6.2)			
Incomplete data	18/98 (18.4)				1/24 (4.2)			
Swam in local water								
Yes	17/28 (60.7)	4.20	2.098 to 8.411	0.0001	3/175 (1.7)	0.349	0.103 to 1.186	0.0401
No	37/256 (14.5)				21/428 (4.9)			
Incomplete data	1/104 (0.96)				1/24 (4.2)			
Had unwell colleague/s								
Yes	24/26 (92.3)	12.85	5.831 to 28.326	<0.0001	14/143 (9.8)	7.05	1.990 to 24.969	0.003
No	13/181 (7.2)				3/216 (1.4)			
Incomplete data	18/181 (9.9)				8/268 (3.0)			

North Atlantic Treat Organisation (NATO) rank ranges; Other ranks=OR (OR1–OR4).
SNCO=senior non-commissioned officers (OR5–OR9) and officers=OF (OF1–OF5).
Incomplete or missing data are shown but omitted from the comparative analyses.

on GI illness during overseas exercises in medium to high-risk settings, confirming that TD remains a cause for concern during British military deployments to Kenya but less so in Oman. Our data highlight the potential higher impact on operational effectiveness during the early phases of deployment. Standardisation of reporting and the use of a combination of data collection methods would improve the accuracy and clarity of reporting. Monitoring of trends and preventive actions should be embedded in smaller deployments including novel settings with limited environmental and other medical support systems.

X S D Woolley @NavyTropMed

Contributors NJB, DSB, MKO'S, SDW and TEF advised on study design and concept. SID, NLR and DSB recruited study participants and administered the questionnaires. BT collated, screened, tabulated and cleaned the data. RT conducted the data analyses and completed the initial drafts of the manuscript. NJB reviewed the data analyses; DSB and NJB revised the first draft of the manuscript. NJB, MKO'S, SDW and TEF reviewed the manuscript. All authors contributed significantly to the final revisions and agreed on the version submitted to the journal and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. RT and DSB are guarantors and accept full responsibility for the work and/or the conduct of the study, had access to the data and controlled the decision to publish.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants; however, approval from Ethics Committee(s) or Institutional Board(s) was not required as per extant Ministry of Defence Research Ethics Committee (MODREC) guidance at the time of data collection. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request. Data that support the findings of this study are available on request from the corresponding author (RT; Romeo.Toriro@lstmed.ac.uk) on reasonable request, provided this meets local ethical and research governance criteria. All data are freely accessible.

of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

ORCID iDs

Romeo Toriro http://orcid.org/0000-0001-5984-5276
S D Woolley http://orcid.org/0000-0002-9385-8975
M K O'Shea http://orcid.org/0000-0001-6414-8088

REFERENCES

1 Riddle MS, Connor BA, Beeching NJ, *et al*. Guidelines for the prevention and treatment of travelers' diarrhea: a graded expert panel report. *J Travel Med* 2017;24:S57–74.
2 Boatwright MA, Kuo H-C, Lindholm DA, *et al*. The Impact of Infectious Disease Syndromes on Activities During Military Travel. *Open Forum Infect Dis* 2023;10.
3 Pogreba-Brown K, Austhof E, Armstrong A, *et al*. Chronic Gastrointestinal and Joint-Related Sequelae Associated with Common Foodborne Illnesses: A Scoping Review. *Foodborne Pathog Dis* 2020;17:67–86.
4 Riddle MS, Connor P, Porter CK. Montezuma's revenge - the sequel: The one-hundred year anniversary of the first description of "post-infectious" irritable bowel syndrome. *World J Gastroenterol* 2018;24:5076–80.
5 Olson S, Hall A, Riddle MS, *et al*. Travelers' diarrhea: update on the incidence, etiology and risk in military and similar populations - 1990-2005 versus 2005-2015, does a decade make a difference? *Trop Dis Travel Med Vaccines* 2019;5:1.
6 Connor P, Porter CK, Swierczewski B, *et al*. Diarrhoea during military deployment: current concepts and future directions. *Curr Opin Infect Dis* 2012;25:546–54.
7 Sanders JW, Putnam SD, Riddle MS, *et al*. Military importance of diarrhea: lessons from the Middle East. *Curr Opin Gastroenterol* 2005;21:9–14.
8 Biselli R, Nisini R, Lista F, *et al*. A historical review of military medical strategies for fighting infectious diseases: from battlefields to global health. *Biomedicines* 2022;10.
9 Riddle MS, Martin GJ, Murray CK, *et al*. Management of Acute Diarrheal Illness During Deployment: A Deployment Health Guideline and Expert Panel Report. *Mil Med* 2017;182:34–52.
10 Connor P, Gutierrez RL. Update on military diarrhoea: current status and future plans. *J R Army Med Corps* 2013;159:136–40.
11 Burns DS, Porter CK, Gutierrez RL, *et al*. Diarrhea and associated illness characteristics and risk factors among British active duty service members at Askari Storm training exercise. *MSMR* 2014;27:32876465.
12 Centers for Disease Control and P. Outbreak of acute gastroenteritis associated with Norwalk-like viruses among British military personnel-Afghanistan, May 2002. *MMWR* 2002;51:477–9.
13 Thornton SA, Sherman SS, Farkas T, *et al*. Gastroenteritis in US Marines during Operation Iraqi Freedom. *Clin Infect Dis* 2005;40:519–25.
14 Bailey MS, Gallimore CI, Lines LD, *et al*. Viral gastroenteritis outbreaks in deployed British troops during 2002-7. *J R Army Med Corps* 2008;154:156–9.
15 Connor P, Hutley E, Mulcahy HE, *et al*. Enteric disease on Operation HERRICK. *J R Army Med Corps* 2013;159:229–36.
16 Burns DS, Riley MR, Mason A, *et al*. UK Role 4 military infectious diseases and tropical medicine cases in 2005-2013. *J R Army Med Corps* 2018;164:77–82.
17 Cox AT, Lentaigne J, White S, *et al*. A 2-year review of the general internal medicine admissions to the British Role 3 Hospital in Camp Bastion, Afghanistan. *J R Army Med Corps* 2016;162:56–62.
18 Sanders JW, Putnam SD, Frankart C, *et al*. Impact of illness and non-combat injury during Operations Iraqi Freedom and Enduring Freedom (Afghanistan). *Am J Trop Med Hyg* 2005;73:713–9.
19 Riddle MS, Savarino SJ, Sanders JW. Gastrointestinal Infections in Deployed Forces in the Middle East Theater: An Historical 60 Year Perspective. *Am J Trop Med Hyg* 2015;93:912–7.
20 Toriro R, Pallett S, Woolley S, *et al*. Outbreak of Diarrhea Caused by a Novel Cryptosporidium hominis Subtype During British Military Training in Kenya. *Open Forum Infect Dis* 2024;11:ofae001.
21 Bricknell MCM, Wright LA. EX SAIF SEREEA II - The Field Hospital Clinical Report. *J R Army Med Corps* 2004;150:252–5.
22 Becker GW, Laundy TJ. A Lesson Not Yet Learned. *J R Army Med Corps* 2003;149:274–6.
23 Davis SI, Biswas JS, White S. Infection Prevention and Control Lead Link Practitioner: a new deployed role piloted on Exercise SAIF SAREEA 3. *BMJ Mil Health* 2020;166:411–3.
24 Riddle MS, Tribble DR, Putnam SD, *et al*. Past trends and current status of self-reported incidence and impact of disease and nonbattle injury in military operations in Southwest Asia and the Middle East. *Am J Public Health* 2008;98:2199–206.
25 Lalani T, Maguire JD, Grant EM, *et al*. Epidemiology and self-treatment of travelers' diarrhea in a large, prospective cohort of department of defense beneficiaries. *J Travel Med* 2015;22:152–60.
26 Ollivier L, Decam C, Pommier de Santi V, *et al*. Gastrointestinal illnesses among French forces deployed to Djibouti: French military health surveillance, 2005-2009. *Am J Trop Med Hyg* 2010;83:944–50.
27 Pommier de Santi V, Nicand E, Lagathu G, *et al*. Incidence, etiology, and determinants associated with acute diarrhea among French forces deployed to Chad. *J Travel Med* 2011;18:115–20.
28 Frickmann H, Hagen RM, Geiselbrechtinger F, *et al*. Infectious diseases during the European Union training mission Mali (EUTM MLI) - a four-year experience. *Mil Med Res* 2018;5:19.
29 Biswas JS, Lentaigne J, Hill NE, *et al*. Epidemiology and etiology of diarrhea in UK military personnel serving on the United Nations Mission in South Sudan in 2017: A prospective cohort study. *Travel Med Infect Dis* 2019;28:34–40.
30 Marimoutou C, Pommier de Santi V, Attrait X, *et al*. Self-reporting compared to prospective surveillance to evaluate the incidence of diarrhea among French Army personnel deployed to N'djamena, Chad. *J Travel Med* 2011;18:217–20.