

Dental care provision to UK military personnel serving on Operation Herrick in Afghanistan.

Part 1: access to dental care

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Key points

Describes the difficulties and risk involved in providing dental care to military personnel.

Explains that dental morbidity will occur, despite efforts to ensure active disease is managed prior to military deployment and that this reduces operational effectiveness.

Highlights that it is not always practicable to provide immediate treatment to deployed service personnel, despite best efforts, related to risk of movement of personnel.

Aims To assess factors influencing access to dental care and to determine the true level of dental morbidity experienced by UK military personnel serving on Operation Herrick. **Methods** Data on dental emergencies were collected prospectively over an 18-month period. Deployed personnel were divided into those co-located with a dental centre and those not co-located. Personnel were separately surveyed on return from Operation Herrick; individuals who had suffered an oral/dental problem whilst deployed were asked to complete a questionnaire. **Results** There were 4,017 dental emergency attendances by 3,355 UK military personnel (282/1,000 man years at risk). A total of 278 non-co-located patients were transported with the sole purpose of seeing a dental officer, 79% by helicopter; a median of 24 hours was lost from their operational role (vs one hour for those co-located). In the cohort surveyed after their return from Afghanistan, 37/118 (31.4%) patients who had wanted to see a dentist whilst deployed did not manage to. **Conclusions** Dental morbidity is common and can affect operational effectiveness, but this risk is reduced by co-location with a dental centre. There is a substantial component of 'hidden' dental morbidity in deployed personnel. Evaluating dental morbidity using dental centre attendees likely underestimates the true levels by approximately a third.

Introduction

Dental disease has long been the scourge of military campaigns, with dental instruments issued free to surgeons within the army of Charles I in 1626.¹ Morbidity due to dental diseases, unrelated to battle, continues to be a major problem for all armed forces, causing suffering and reducing fighting efficiency.²⁻⁵ In a French Army force deployed to Mali in 2013, 15.7% (54/338) of all medical evacuations during a three-month period, including

battle injuries, were to facilitate treatment of dental disease.⁶ 'Dentally well-prepared' forces can expect approximately 150 cases of 'dental emergencies' (DE) per 1,000 man years at risk (MYAR);^{3,7-10} although this varies from 220-293/1,000 MYAR even in a well-funded, first-world army to 26/1,000 MYAR in the US Navy Submarine Service.^{6,11,12} While many cases can be dealt with on military operational deployments by a dental surgeon, oro-facial disease, not related to injury, accounted for 4.9% of all US military international medical evacuations from Iraq and Afghanistan in 2003/4.⁵

Approximately 9,500 UK troops were stationed in Southern Afghanistan in 2012 as part of the mission, Operation Herrick (OpH).¹³ These soldiers, sailors and airmen were based in 137 separate locations spread over a vast area, mainly in Helmand Province.¹⁴ Individual detachments, as small as 30 personnel, were

commonly situated in remote, hostile localities, some of which could only be reached by helicopter. Provision of dental support to this disparate patient population presented an array of significant challenges, not least the risks inherent in transporting patients to obtain care.

While previous studies have reported the scale and nature of DEs seen by deployed dental surgeons the definition of what constitutes a DE varies and none has accurately determined how patients access dental care and how this is affected by location, nor the scale and reasons for any delays or inability to obtain care.^{2,3,7-9,11,12,15-19} The aim of this paper was to evaluate the factors influencing access to dental care for military personnel deployed on OpH, in terms of ability to access care and reasons for delay in receiving treatment. A non-deployed 'Home Base' (HB) group of military patients was used as a control sample.

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Materials and methods

Three different data sources were used to achieve the aim of this study: Prospectively collected observational data on DEs occurring on OpH and at HB and a retrospective survey of troops recently returned from Operation Herrick (RetOpH).

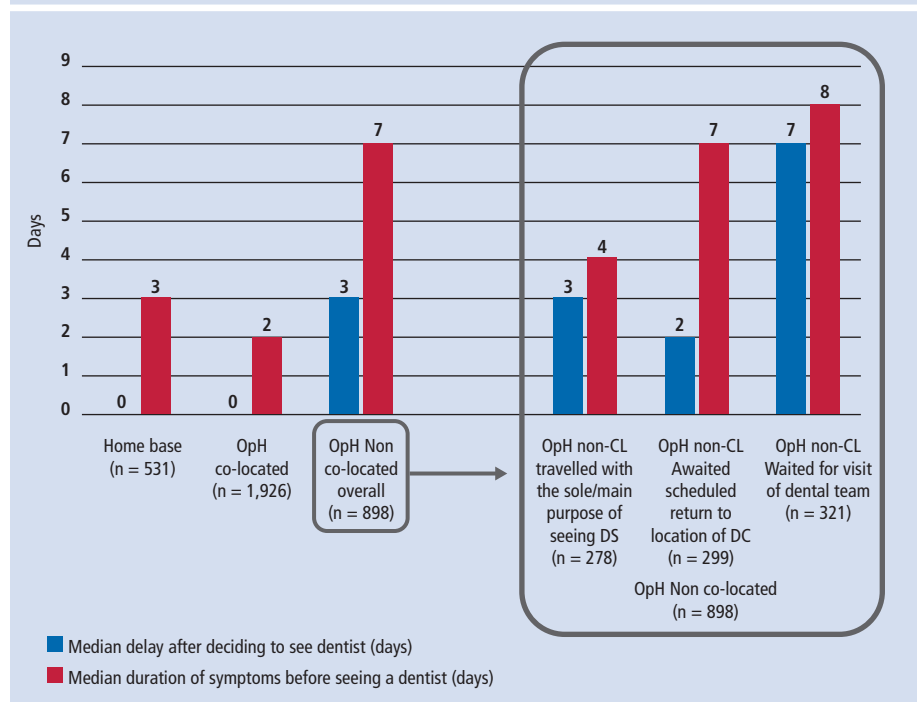
OpH group

On OpH, UK Armed Forces Dental Officers worked at two static dental centres (located at the main hubs with the airports) as well as conducting occasional peripatetic clinics using portable dental equipment. They contemporaneously recorded datasets onto a specifically designed Microsoft Excel spreadsheet for all UK service personnel presenting as a DE while deployed on OpH between May 2011 and October 2012. The details recorded were: military demographics, location while deployed, method of travel to the dental centre (DC), time taken for the journey, the reason for any delay in accessing dental care and the reason for attendance. Time lost from operational role was calculated by assessing the transport travel time to the DC (if it was not transport that the individual was scheduled to take) and time lost from work as a direct result of the dental problem, before and including the appointment at the DC. However, time spent travelling back to their operational base and any subsequent time lost was not recorded due to the difficulty in making an accurate assessment as individuals could not be contacted and travel times back to remote locations were very variable.

To address the primary aims of assessing the impact of operational place of duty and patients access to dental care, patient data were allocated into two main cohorts:

1. Operation Herrick co-located group (OpH CL), who were co-located with one of the two static dental centres in theatre, being in close proximity to dental care
2. Operation Herrick non-co-located Group (OpH non-CL), who were based at satellite locations and required transport to the static dental centres or peripatetic clinics for care. From November 2011-October 2012, this cohort was further evaluated as three sub-groups:
 - Individuals who travelled to the location of the DC with the 'sole or main purpose of seeing the dentist'
 - Individuals that 'awaited their scheduled return' to the base where the DC was

Fig. 1 Median delay and duration of symptoms, with further breakdown for the OpH non-co-located group (OpH non-CL)



located (usually while rotating out of the theatre of operations)

- Personnel who 'waited for the visit of a dental team' to their location (relatively rare, peripatetic clinics using portable dental equipment).

HB group

As means of a control, dental surgeons working at all of the UK Defence Dental Centres entered the same datasets as on OpH onto a specifically designed Microsoft Excel spreadsheet for all emergency attendances made by UK service personnel not engaged in military operations during a one-week period in 2012.

RetOpH group

The RetOpH arm of the survey was conducted when the units were 'on parade' within two months of their return from OpH. This retrospective, third 'arm' of the study aimed to determine the 'true' level of oral disease and the barriers to accessing care for patients, with particular reference to those individuals who had wanted to see a dental surgeon (DS) in theatre but had not managed to do so. Individuals who had suffered an oral or dental problem while deployed were asked to complete a previously piloted questionnaire. Data were entered onto a specifically designed Microsoft Excel spreadsheet.

This study was approved by Colonel R. McCormick L/RADC, then Defence Consultant

Advisor in Public Health Dentistry and permission to submit for publication was granted by the Director of Research, Royal Centre for Defence Medicine.

Statistical analyses were made with the aid of IBM SPSS Statistics for Windows (version 20.0, IBM Corp, Armonk, NY, USA). The chi square test was used to assess the significance of differences between the groups. Probabilities of <0.05 were accepted as significant.

Results

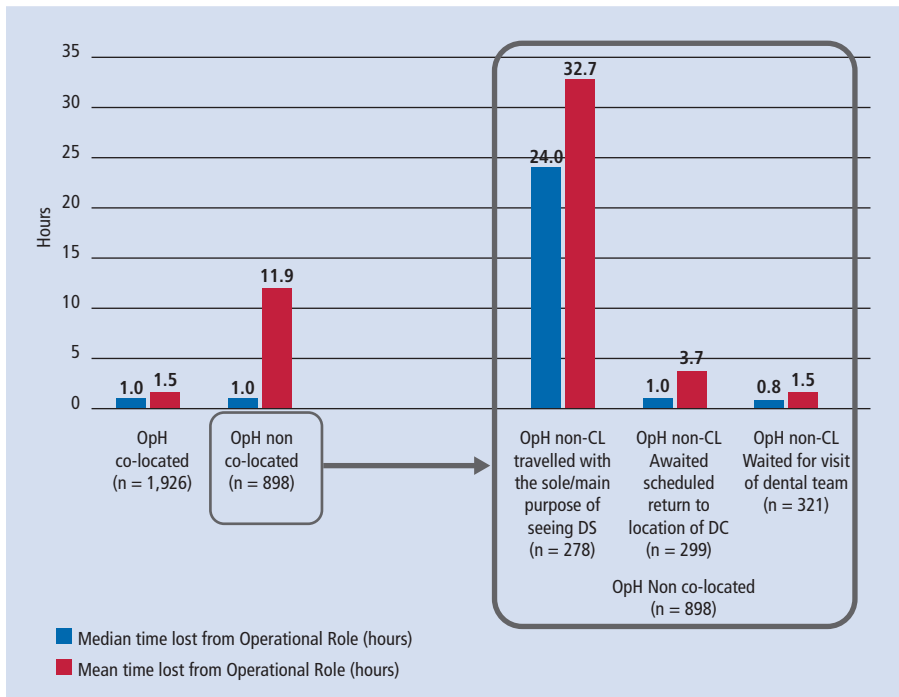
OpH group

In the 18-month period studied on OpH (May 2011 – October 2012) there were approximately 9,500 UK troops in Afghanistan,²⁰ albeit a constantly changing population. There were 4,017 dental emergency attendances by 3,355 UK service personnel, a rate of 223.2 attendances per month, an attendance rate of 282/1,000 man years at risk (MYAR). A total of 2,873 (85.6%) attended once, 353 (10.5%) twice, 98 (2.9%) three times, 23 (0.7%) four times and ten more than four times. Of the patients, 23 had more than one presenting problem at a single attendance, making 4,040 problems in total.

HB group

This control group encompassed 531 emergency attendances by British military personnel at UK Military Dental Centres

Fig. 2 Time lost from operational role, up to the point of seeing dental surgeon, with breakdown of delay for the OpH non-co-located group (OpH non-CL)



during a one-week period in 2012. This equated to an approximate rate of 180/1,000 MYAR, given the size of the UK Armed Forces at that time (approximately 168,000), less those on operational duty.²⁰

OpH non-CL group

From November 2011 to October 2012, of the 2,835 patients seen, 31.9% (904) were not co-located with the DC (OpH non-CL), with complete data sets collected for 898/904. Comparative data for median delay in obtaining dental treatment and median duration of symptoms before seeing a dentist for the OpH and HB patients is presented in Fig. 1. 'No delay' is defined as the individual seeing a dentist on the day they reported sick.

Of the OpH non-CL patients, 34.2% (307/898) were seen with no delay, compared with 75.5% (1,455/1,926) in the OpH CL group. This equates to relative risk of 2.69 (95% CI 2.46–2.95) for delay in treatment in non-co-located personnel.

Of the OpH non-CL patients, 31.0% (278/898) travelled with the 'sole or main purpose of seeing the dentist'. Of these, 79.1% (220/278) travelled by helicopter, 17.6% (49) by road vehicle, two by fixed-wing aircraft and seven by other means. For 53 of these individuals the journey involved specially arranged or diverted vehicles (rather than routine transport) including 23 helicopter flights and 27 road journeys.

In the OpH non-CL group, the reasons for delay were: being 'too busy at work' in 66.7% (398/597), and 'lack of safe transport' or a 'wait for routine transport' in 19.9% (119/597). Transport was not a factor for those in the OpH CL and HB groups, but pressures at work were responsible for very similar proportions of delay in both groups – 45.6% (217/476) and 44.9% (57/127), respectively. 33.1% (42/127) at HB waited for the next routine appointment, while this did not happen in the OpH group as there were no 'routine' appointments. Time lost from operational role was greatest for the OpH non-CL group and within this cohort was highest for patients who travelled specifically to see the DS (Fig. 2).

A comprehensive breakdown of the pain symptoms for OpH and HB is shown in Fig. 3. The proportion attending with pain lasting longer than 60 minutes at HB was 12.1% greater than on OpH (28.1% vs 16.0%; $\chi^2 = 46.6$, $p < 0.01$). Conversely, the proportion of patients on OpH attending with no pain was 8.5% greater than at HB (48.2% vs 39.7%; $\chi^2 = 11.0$, $p = 0.01$).

Of the 53 OpH non-CL patients who had transport arranged specifically in order to see the DS, 30.2% (16) had pain longer than 60 minutes, 22.6% (12) had pain lasting fewer than 60 minutes but more than five minutes and the remaining 47.2% (25) had pain that lasted up to five minutes or were pain-free. On OpH overall,

450 individuals had pain lasting more than an hour that also woke them. For this cohort, there was no median delay in obtaining treatment, no matter whether they were co-located with the DC or in another location.

RetOpH Group

A total of 1,237 UK service personnel were surveyed in the RetOpH study. Of those surveyed, 11.4% (141/1,237) stated that they had suffered an oral/dental problem during their six-month tour of duty, an incidence of 228/1,000 MYAR. Of those, 74.5% (105/141) were not co-located with a DC in theatre. All of those who admitted to an oral/dental problem completed the questionnaire.

In the RetOpH cohort, 74.5% (105/141) suffered pain as the result of their dental problem. In 22.7% (32/141) this pain woke the patient, compared with 17.2% (696/4,040) and 20.7% (110/531) in the OpH and HB groups respectively. Of those who suffered pain as the result of their dental problem, 27.6% (29/105) stated that their ability to do their day to day work was affected 'a bit', while 6.7% (7) individuals felt that their ability was affected 'a great deal', with 61.9% (65) claiming no detriment.

Eighty-three per cent (118/141) of individuals in the RetOpH arm wanted to see a DS, however 31.4% (37/118) did not manage to do so; for those not co-located with a DS, this proportion was 37.4% (34/91), compared with 11.1% (3/27) for those who were co-located. In the non-co-located group, 71.4% (25/34) cited that they were 'too busy operationally' to see the DS, while 11.7% (4/34) waited for a DS visit that did not occur, the reason being unknown in five cases. Individuals were asked to give reasons why they did not manage to see the dental surgeon; examples included:

- 'I didn't go to the dentist because I didn't want to be out work (sic), miss any contacts (contact with the enemy that is, combat) and make CVRT (small armoured vehicle) crew ineffective and have no sniper asset for however long I would have had off'
- 'I would have seen a dentist but operational tempo was starting to pick up and if I had gone then my vehicle would have been ineffective on the ground as it would not have had a driver'
- 'Due to the fact that I would have had to go to Bastion (location of DC) from LKG (another British base) it would have taken too long. The problem was caused by half of my wisdom tooth falling out and causing considerable gum pain.'

Discussion

The aim of a deployed military dental service is to maintain fighting effectiveness and minimise suffering related to dental morbidity. Any study that examines military health experience on operations will have its parameters limited by the restraints created by the operational tempo of combat. Although it would have been ideal prospectively to match the cohorts, operational needs will always take precedence. Consequently, the study relies on the different groups being evenly matched by their composition of military personnel with even distribution of sexes, mainly early adulthood age-range and being medically fit. The HB group gave insight into service personnel presenting for DE when not deployed operationally. The one-week time frame for data collation provided over 500 cases but it is acknowledged that this may not have been of sufficient length to provide a valid picture of dental morbidity. The short duration of the HB arm was the result of a need to minimise additional time pressure on clinical teams who were also conducting routine treatment, unlike on OpH.

UK service personnel undergo mandated, periodic dental inspections (usually annually) and subsequent care to eliminate primary disease and improve oral health in an attempt to ensure that the individual attains a standard NATO-categorised level of 'dental fitness' so as to be deployable at 'low risk of dental morbidity'. These treatments are provided by

both UK military and UK military-employed civilian dental surgeons who have been specifically trained in the required standards, follow protocols and whose work is periodically audited (yearly to every three years, depending on clinician experience, degree of isolation and performance at audit) to ensure compliance with standards. Approximately 90% of the UK troops who deployed to Afghanistan in 2011/12 were classified as 'dentally fit' by NATO standards, yet the OpH results confirm previous findings that, even when a force is dentally 'well prepared', a level of dental morbidity can be expected.^{3,7-10} This study suggests poor correlation of NATO 'dentally fit' categories and risk of dental morbidity. In NATO categorisation, individuals are classified as dentally fit if dental disease is absent clinically, or has been treated. However, this system fails to account for the increased risk of morbidity associated with the presence of multiple restorations, asymptomatic but partially erupted wisdom teeth or previous endodontic treatment and relies to a certain extent on the interpretation of the practitioner.

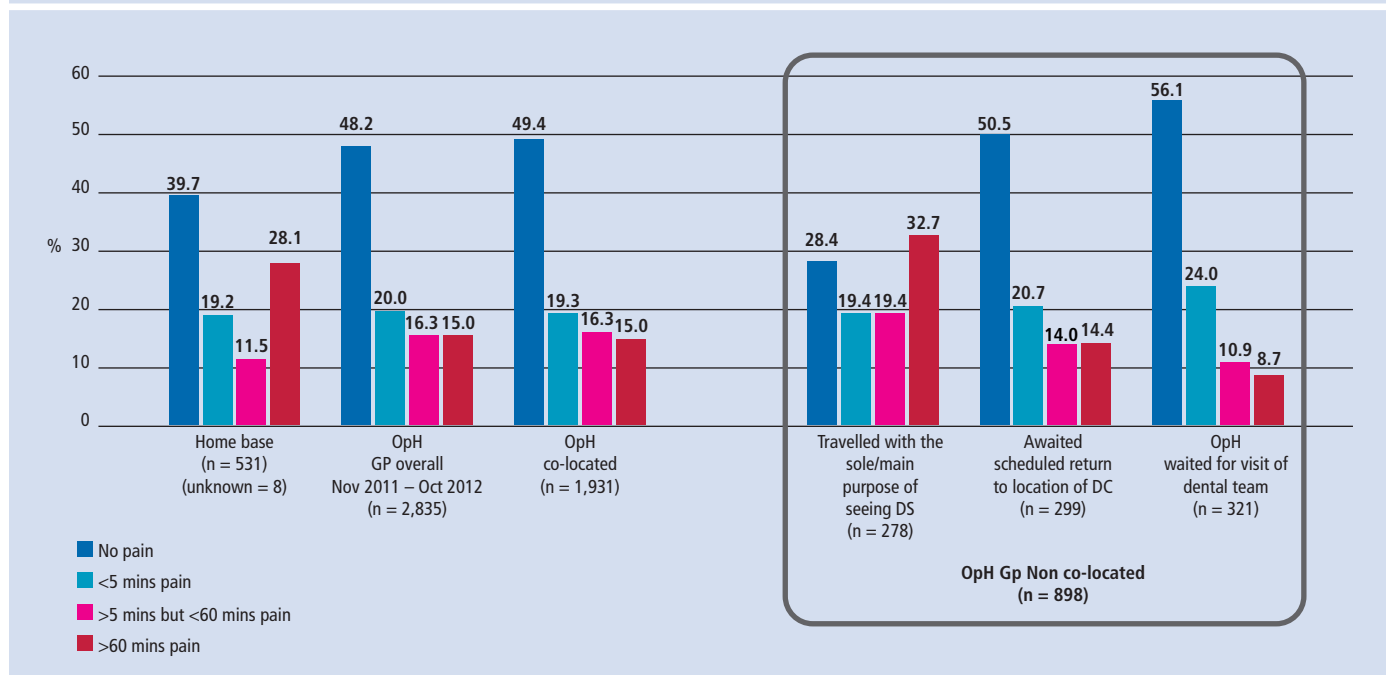
Whether all attendances are 'true' dental emergencies (DEs) has been questioned before and is pertinent in this study as 48% of patients in the OpH group were in no pain.^{3,7,15} Armed forces report differing rates of 'unpreventable' emergency dental visits in dentally 'well-prepared' forces; 53% of US Navy and Marine Corps and 75% of UK dental attendances in Iraq during the Second Gulf War were considered

'unpreventable',^{3,17} compared with 22% in French Army personnel in Afghanistan.¹¹ This may depend upon the definition of a DE – this study included any individual who presented for advice or treatment, as this was deemed the true treatment need. The US Army defines a DE as 'an acute episode of a dental or oral condition which becomes painful or threatens to become systemically debilitating.'²¹ It could be reasoned that patients presenting as a dental emergency are likely to have concerns that non-painful tooth problems may become painful or 'systemically debilitating'.

The cohort in the OpH non-CL group that travelled with the 'sole or main purpose of seeing the dentist' could be considered as the most representative group for 'true' DEs. Despite this, approximately half of these patients had experienced no pain, although this was almost half that of those who were co-located with the DC (28.4% vs 49.4%). Similarly, in the cohort who travelled with the sole or main purpose of seeing the dentist, the proportion of those with pain lasting longer than 60 minutes was more than double the rate found in those in the OpH CL cohort (32.7% vs 15.0%).

Although approximately half of all British military personnel on OpH were co-located with a DC in theatre, of the patients seen for DEs, 68.1% (1931/2865) were co-located (OpH CL). This distribution of DEs was similar to previous findings from a third molar-related morbidity study of British military personnel

Fig. 3 Proportion of patients with pain and duration of that pain as a presenting feature



serving within the same theatre of conflict.⁴ For those in the OpH CL group, there was no median delay in obtaining treatment, matching care at HB. Furthermore, for deployed troops, the median delay in obtaining treatment for those in the OpH non-CL group was three days, which, given the environment, risks and disparate nature of bases is commendable. Notably, on OpH there was no median delay in acquiring treatment for the 450 individuals who had pain lasting more than an hour that also woke them, irrespective of whether they were co-located with the DC or in another location.

Inevitably, given the widely dispersed nature of the fighting force, movement of personnel to receive dental care was necessary. Fifty-three patients were moved to the DC by 'specially arranged or diverted transport', almost half in helicopters. Critically, this puts the individuals operating the transport and patient at risk, as well as diverting important military assets thus reducing fighting effectiveness. Almost half of the transported patients had experienced no pain, which is potentially concerning. However, pain may not always be an accurate marker of clinical severity, as illustrated by the patient who travelled on specially arranged transport with a painless swelling that was diagnosed as a probable salivary gland malignancy on CT scan. Movement of patients with dental morbidity was a significant problem for French forces in Mali in 2013, when, in a three-month period, 54/338 (15.7%) of all medical evacuations were to facilitate treatment of dental disease.⁶

Overall, the proportion of patients seeking help for pain lasting more than an hour was 75% greater in the HB group than in the OpH group (28.1% vs 16.0%; $\chi^2 = 46.6$, $p < 0.01$), perhaps indicating that troops are more likely to wait until they experience 'significant' pain before seeking care when at HB. Furthermore, the rate of emergency attendance was 56% higher on OpH than at HB (282 vs 180/1,000 MYAR) and the rate of presentation having experience no pain was 21% higher (48.2% vs 39.7%; $\chi^2 = 11.0$, $p = 0.01$). This variance may be explained by UK service personnel being well informed regarding the risks of untreated, painless dental disease and the imperative of taking individual responsibility for their 'fitness to fight'. This understanding, combined with the knowledge that access to care may not always be

possible while deployed, may well lead them to seek help at an earlier or opportune moment for a condition that they might simply ignore until their next regular, mandated military dental inspection when at HB.

The RetOpH survey demonstrated that in a cohort of over 1,200, the vast majority of whom were not co-located with a DC in theatre, almost one third of individuals who wanted to see a dentist did not manage to do so. This discrepancy in attendance rates between the CL and non-CL arms may indicate that the convenience sample, used in the OpH study, was an underestimate of the true incidence of dental morbidity. Similar findings have been noted before; von Wilmowsky *et al.*¹⁰ found that in a naval fleet, those on ships without a DC only attended the DC in an emergency, as opposed to those on a ship with a DC who attended for more routine treatment.

The quotations from the RetOpH survey shed light on the UK Service person's mind set within an operational framework. While Service patients do assess the benefit to themselves of seeking treatment, it is evident that they also consider the risk to others if they leave their place of duty.

Conclusion

The arms of this study facilitate an accurate assessment of the challenges involved in providing dental support to deployed troops fighting an asymmetric war, based in 137 different locations separated by hostile territory. Even this study's dentally well-prepared deployed military force experienced a high frequency of presenting dental problems that impacted fighting efficiency. Specifically, personnel without a co-located dental centre were transported for treatment, entailing risk to personnel and increased likelihood of both delayed treatment and loss of man hours from place of duty. Furthermore, the RetOpH arm of this study revealed that previously published estimates that have used convenience data samples of those who managed to attend a dental facility underestimated the true burden of dental disease within a deployed fighting force. However, given the specific challenges, there would appear to have been an effective process for the timely management of dental problems in UK troops during Operation Herrick. The study confirmed the effectiveness

of uniformed dental surgeons in the deployed environment to deal with unpreventable dental morbidity.

Acknowledgements

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