

Defence dentistry: an occupationally focused health service with worldwide deployable capability

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Key points

Illustrates how Defence dentistry utilises public health principles to deliver occupationally aware, preventive-focused dental care across a global footprint.

Describes the impact of dental morbidity on military operations and the rationale for deployable military dental teams to provide clinical leadership and dental care in the operational environment.

Describes the unique advantage that uniformed military dental capability delivers in supporting UK Armed Forces to provide an agile response to global challenges.

Abstract

Oral disease can cause substantial disruption to service personnel, resulting in debilitation and reduced effectiveness while deployed on military operations. As such, Defence dentistry delivers an occupationally focused dental service that is deployable, agile and holistic, to ensure service personnel are dentally fit for operations and that the impact of dental morbidity is minimised.

Defence dentists provide a unique service, balancing the needs of the individual while considering their operational role requirements. This enables the UK Armed Forces' oral health to be optimised by mitigating morbidity and maintaining operational capability while deployed.

The aim of this paper is to highlight the key principles of Defence dentistry by discussing the public health values and occupational focus which underpin a patient-centred approach and the agility of the uniformed military dental workforce in providing a responsive and deployable care capability.

Introduction

Defence dentistry delivers a service which is uniquely tailored to support the UK Armed Forces (UKAF) as it uses its global reach to ensure security, support national interests and safeguard the UK's prosperity.¹ While the clinical aspects are familiar, Defence dentistry blends patient-centred care with a public health perspective to deliver an occupationally focused service that is deployable, agile and holistic (Table 1).

The impact of oral disease on service personnel serving on operations has been well documented^{2,3,4,5,6,7} and can substantially disrupt operational capability. Defence dentistry's role is to deliver effective oral

healthcare to service personnel in order to minimise dental morbidity and maximise the operational effectiveness of the UKAF.⁸

Within UKAF bases, dentistry is delivered in a military-led model, with military dentists across the three uniformed Services (Royal Navy, Army and Royal Air Force) and Civil Service dentists working together alongside mixed military/civilian teams of dental nurses, hygienists, therapists and support staff to prepare the UKAF for operations. Military dental clinics are distributed across the UK and overseas locations, often co-located with military medical centres to enable service personnel to access care, close by their duty station. In the operational context, military uniformed dental personnel deploy to provide emergency and comprehensive dental care to the deployed force to sustain operational capability.

Patient-centred care with a public health perspective

Defence dentistry seeks to manage and prevent oral disease in line with the overarching Defence Mental Health and Wellbeing strategy,

by applying a life course approach to health inequalities adapted to a military context to ensure service personnel join, train, live, work and leave well.^{9,10}

The UKAF comprise a unique population, unlike any other in British society, with a distinct age, sex and sociodemographic profile (Fig. 1),^{11,12} who are distributed widely across UK and overseas locations. As at 1 April 2019, 24% of UKAF personnel were under 25 years of age. The average age of an officer was 37, while the average age of all other ranks was 30. By gender, 11% of those serving were female. Although sociodemographic data are not routinely collected, research undertaken using the Index of Multiple Deprivation (IMD) has demonstrated 62.7% of non-officer Army personnel were recruited from the most deprived quintiles (1 and 2) compared to 42.5% and 36.6% of Royal Navy and Royal Air Force, respectively.¹³

Prospective examination of UKAF non-officer recruits at enlistment has found significantly greater levels of active caries and treatment need compared to that of the UK general population. Overall, UKAF recruits demonstrated 2.0 decayed teeth per recruit

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(with a median age of 20 years), compared with 0.9 in the similarly aged UK general population, potentially indicating a greater initial need for restorative care in UKAF recruits; however, direct comparison is made with caution due to differences in study methodologies.^{13,14}

This work demonstrates inequality is evident among recruits to each of the single Services; an average of 2.6 decayed teeth per recruit was found in Army recruits, compared with 1.9 in Royal Navy recruits and 1.3 in Royal Air Force recruits, which when cross-tabulated by IMD quintile demonstrated a strong correlation between deprivation and disease experience.¹³ This inequality has been explored as part of the Defence Oral Health Needs Assessment, where data have been utilised to determine dentist-to-patient planning ratios to address gaps and inequalities in dental care provision across the UKAF, taking into account recruit training locations, anticipated treatment need and the average length of military service.¹⁵ It is acknowledged that socioeconomic differences may only form part of the picture and education level, although linked, is also likely to be a significant factor, as the majority of trades within the Royal Navy and Royal Air Force require academic qualifications and/or technical trade training, in contrast to the Army where this is a relatively smaller proportion. At population level, UKAF dental fitness data have been structured into a series of healthcare management dashboards. These are critical to identify inequalities and enable effective analysis of dental treatment need across Defence, in order to prioritise resource

Table 1 Defence dentistry blends five key principles to ensure UKAF service personnel are effectively supported throughout their military career (UKAF = UK Armed Forces, NATO = North Atlantic Treaty Organisation)

Principle	Summary
Patient-centred care with a public health perspective	Dental care delivered using a life course approach to ensure service personnel join, train, work, live and leave well
Occupational focus	Clinical decision-making focused on the patient's occupational role and the environment in which they will operate. Considers factors such as the duration, remoteness and austerity of the deployment
Deployable	Provision of dental care to UKAF service personnel in the deployed environment to sustain operational effectiveness. Delivered to UK standard and fully interoperable with NATO partners
Agile	A responsive uniformed dental workforce with strong individual and collective leadership ethos that can move assets between locations and adapt quickly to rapidly changing situations in both UK and overseas bases and in operational environments
Holistic	Preventive-focused oral health that seamlessly integrates with wider prevention pathways across a range of lifestyle initiatives (including alcohol, tobacco, diet and weight management)

allocation. Future work aims to develop these dashboards to integrate outcomes on population health, patient experience, patient safety, clinical effectiveness, and capacity and access (Fig. 2).

Patient feedback is crucial to the delivery of a responsive dental care service that balances the needs of the individual with those of Defence. For the last three years, the annual UKAF Continuous Attitude Survey has consistently cited Defence dentistry as the second greatest retention factor for staying in the UKAF after job security, highlighting it as a valued benefit to both morale and culture among serving personnel.¹⁶

As Defence dentistry is unable to influence the dental disease individuals experience

before enlistment, it is therefore vital that existing disease is addressed early in a recruit's military career. This prevents an influx of oral disease into the trained force and emphasises preventive measures to limit further disease during their military service. To address the burden of untreated disease, an intervention known as 'Project MOLAR' was implemented in 2006, based on a retrospective analysis of recruit dental records which demonstrated 85% of Army recruits could be made dentally fit by the provision of up to two hours' dental care during their initial military training.¹⁷ This intervention ensures all recruits receive preventive and operative dental care during their initial recruit training to address their dental health needs. Short-term evaluation of

Fig. 1 Comparison between the UK population¹¹ (April 2019) and the regular UKAF population¹² (April 2019)

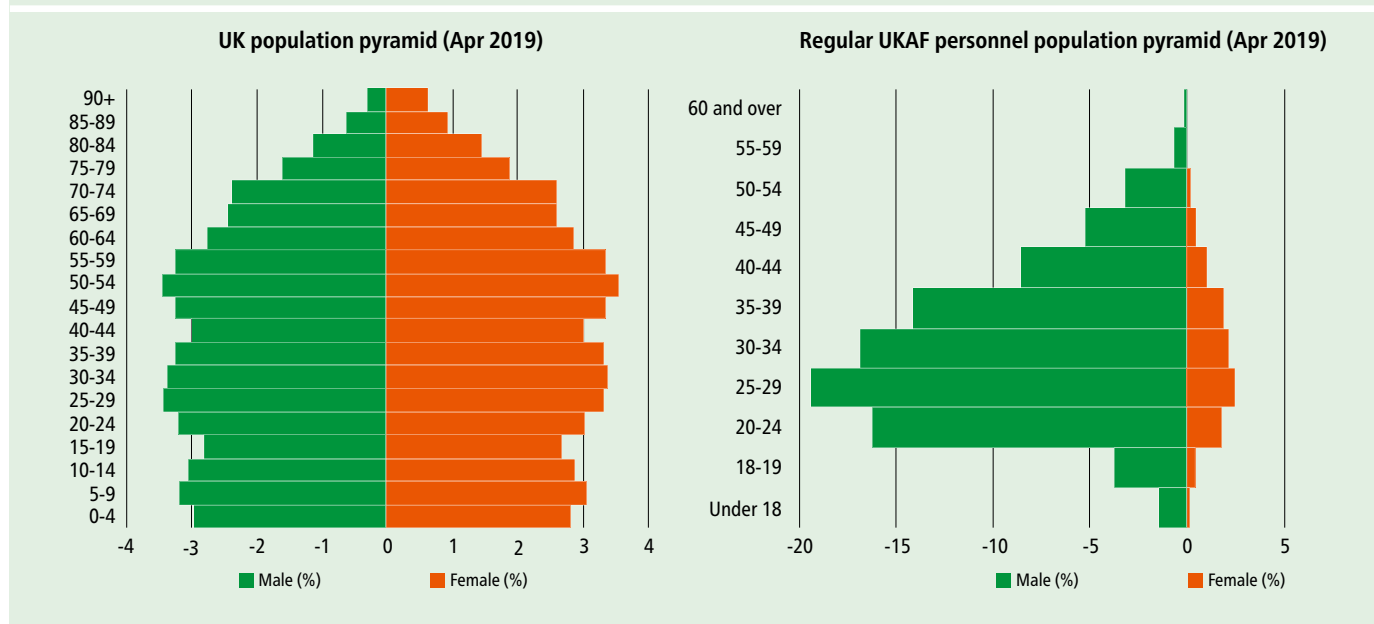
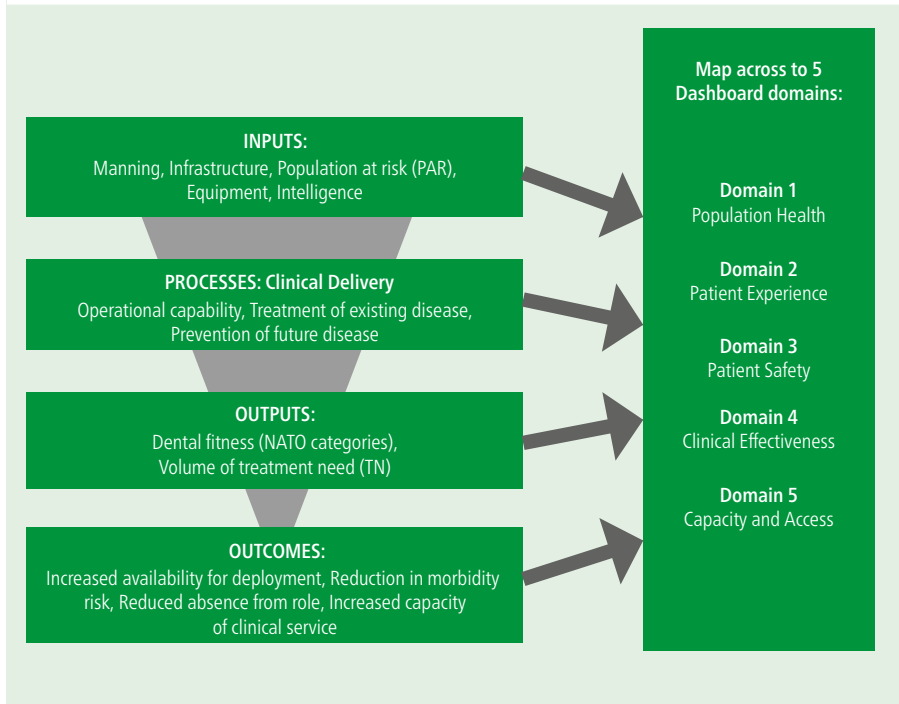


Fig. 2 Dashboard schematic demonstrating the relationship between Defence dentistry inputs, processes, outputs and outcomes, which map across to five dashboard domains



the Project MOLAR intervention consistently demonstrates approximately 90% of recruits have all their dental treatment need met by the time they complete initial military training. Further to this, longitudinal analysis has demonstrated that those individuals who have their treatment need met during initial recruit training are 30% less likely to experience dental morbidity (RR: 0.70–95% CI: 0.63–0.76) for up to five years following the intervention and 64% less likely to experience subsequent dental disease (OR: 0.36–95% CI: 0.28–0.47) for up to 18 months, compared with personnel that did not complete the Project MOLAR intervention.¹⁸

Occupational focus

Defence dentistry is unique in that it is mandated to deliver dental care to a defined and published occupational standard as outlined in North Atlantic Treaty Organisation (NATO) and Ministry of Defence (MOD) policy documentation.^{19,20} These standards

Table 2 Example UKAF clinical scenarios highlighting potential clinical and military occupational considerations

Clinical scenario	Clinical considerations	Occupational considerations
An Army armoured vehicle commander presents with food packing and mild pericoronitis from a partially erupted mesially impacted lower third molar, before a four-month deployment in an austere location	Has the patient had previous episodes of pericoronitis? If so, what frequency, severity, predisposing factors? Can the patient maintain good oral hygiene? Is any pathology present (for example, caries etc)? What are the potential risks to surgery (for example, inferior alveolar nerve considerations etc)?	How long is it until the patient deploys? Where is the patient deploying to and what dental care is available? If no UKAF dental care, are other NATO medical/dental forces available? What conditions will the patient be living in and will they be able to conduct thorough oral hygiene? Will the patient be co-located with medical facilities during their deployment? If not co-located, how long would they be away from their primary role if they had to travel to seek care? What transport/personnel requirements would be required to transport the patient (for example, road move/helicopter)? What are the risks to transporting the patient (for example, potential improvised explosive devices etc)? What is the patient's specific operational role and what are the implications to the unit if this individual is removed from post for a period of time?
A submariner presents with a periapical abscess in a molar tooth before a six-month submarine deployment. The vessel will be continuously at sea for the duration of the deployment with no access to dental care	Is the tooth restorable? What is the risk status of the patient and are they able to maintain good oral hygiene? If the tooth is restored, how likely is the root canal treatment and definitive restoration to succeed? What are the potential risks? If the tooth is extracted, what are the potential risks?	How long is it until the patient deploys? Is there sufficient time to complete the treatment and provide a cuspal coverage restoration? What implications may a temporary restoration have (for example, barometric pressure changes etc)? What conditions will the patient be living in and will they be able to conduct thorough oral hygiene and comply with aftercare instructions? How successful is the treatment likely to be over the six-month deployment period? How long will the patient be without access to emergency care? What are the implications of a dental emergency for the patient and to the mission if this individual is unable to conduct their operational role?
A pilot presents with sudden onset barodontalgia pulpitis symptoms during a flying operation from an upper molar tooth that has recently had a deep direct restoration placed. They are about to depart with the squadron for a month of flying operations based in a remote desert location	What recent dental work has been conducted? Are there any other exacerbating factors? On clinical/radiographic examination, are there defective restorations (for example, fractured, cracked or with voids), caries, pulpal changes etc?	When is the patient next due to fly? What are the implications to the operation if this patient is unable to fly? What implications may medications (including local anaesthetic) have on the patient's ability to fly? What implications may a temporary restoration have on the patient's ability to fly? Will the patient need to be grounded for a period of time in order to address their dental condition? Will the host nation be able to support with military dental care?

underpin interoperability (between the UKAF single Services [Army, Royal Navy, Royal Air Force], NATO partners, military of other nations and the United Nations etc), which is increasingly important due to the complexity of modern warfare. They are essential to ensure patients from partner agencies and other nations can be managed consistently and safely by contributing dental services. Clinical decisions must balance the needs and demands of the individual with their occupational role, and the austere environments and remote locations in which they may be required to operate for extended periods (Table 2).

Regular oral health assessment is the foundation for occupationally focused decision-making principles. This ensures service personnel are appropriately supported in accordance with their risk status and occupational requirements to provide preventative and, where required, interventional or operative treatment. Within Defence dentistry, oral health assessments are termed periodic dental inspections with recall intervals determined by risk status in accordance with the National Institute for Health and Care Excellence (NICE) dental recall guidelines.²¹ During an inspection, a risk assessment is undertaken in relation to caries, periodontal diseases, tooth surface loss and oral cancer. Following this, personnel are assigned a NATO dental fitness category (DFC) (Table 3) and are required to attend for preventive care in accordance with their risk category and any interventional or operative treatment required to render them dentally fit.¹⁹ The NATO dental fitness classification system is key to interoperability, and was formalised into NATO policy in 1998 and originated from the US Department of Defense dental classification developed during the 1980s.^{19,22} This classification sets agreed definitions of dental fitness across NATO members in order to convey dental risk to military commanders.

While the NATO dental fitness classification system is a helpful triage tool, it is subjective and lacks sensitivity as a risk predictor of subsequent dental morbidity.²³ Although the system demonstrates a greater proportion of dental morbidity occurs in personnel categorised as dentally unfit,^{4,23,24} a substantial amount of dental morbidity can still be expected in individuals classed as DFC1 (dentally fit). This is because the system does not take into account the increased risk of morbidity associated with the patient's cumulative

Table 3 The NATO dental fitness classification (DFC = dental fitness classification, PDI = periodic dental inspection)

NATO category	Definition
NATO DFC 1	Service personnel in date for their PDI who require no active interventional or operative dental treatment. In the opinion of the clinician, it is unlikely that they will present with a dental emergency within their dental recall period (dentally fit)
NATO DFC 2	Service personnel in date for their PDI who require active interventional or operative dental treatment and whose existing dental condition, in the opinion of the clinician, is unlikely to result in a dental emergency within their defined dental recall period
NATO DFC 3	Service personnel in date for their PDI who require active interventional or operative dental treatment and whose existing dental condition, in the opinion of the clinician, is likely to cause a dental emergency within 12 months
NATO DFC 4	Service personnel who are beyond their dental recall date and require a PDI

exposure to dental disease/treatment (for example, presence of multiple restorations, previous endodontic treatment etc), partially erupted but asymptomatic third molars, and unpredictable events such as traumatic dental injuries and aphthous ulceration.^{2,23} However, individuals categorised as DFC3 may expect a 51% (RR: 1.51–95% CI 1.43–1.59) increased likelihood of experiencing a dental emergency as those categorised as DFC1. Deployment of a force categorised as DFC1 is therefore a pragmatic method of reducing the risk of dental morbidity but cannot eliminate the risk entirely; therefore, emphasis must also be placed on preventive strategies throughout a service person's career alongside the provision of deployed dental capability to manage dental morbidity that does arise on military operations.

Deployable

Worldwide, across military populations, dental morbidity poses substantial challenges while deployed on operations and a literature review has suggested that 150–200 dental emergencies may be expected per 1,000 personnel per year in a force that has been actively assessed and treated.³ Subsequent studies have reported similar rates of between 145–153 dental emergencies per 1,000 personnel per year in US Armed Forces personnel, and within the UKAF, between 148–160 dental emergencies per 1,000 personnel per year.^{5,6} Direct comparison between studies is not possible due to differences in study design, including the definition of dental emergency used, the study population, study duration, environment and level of access to dental services. In addition, it is challenging to calculate accurate population figures in operational environments due to complex personnel movements, which leads to uncertainty when conducting dental

emergency calculations. However, these studies demonstrate that, despite proactive preventive-focused pre-deployment dental care to prepare the force, there remains an irreducible burden of oral disease experienced on military operations.

Evaluation of military personnel returning from Operation Herrick (the UKAF mission in Southern Afghanistan between 2002–2014) has demonstrated 31.4% of individuals who experienced a dental problem while on operations did not manage to access dental care, indicating that data from operational studies may underestimate true morbidity levels.² Operational tempo was cited as one of the most frequent barriers to accessing care, with service personnel balancing the personal benefit of accessing care against the risk to their unit if they had to leave their operational role for a period of time.

Recent conflicts have focused attention on the effects of 'disease and non-battle injury' (DNBI) of which dental morbidity forms a substantial proportion. Operational health surveillance reporting has established dental emergencies consistently feature in the top five most common UKAF DNBI presentations during operations, reinforcing the need for deployable dental teams to support operations.⁸ Analysis of UKAF dental emergency presentations during operational deployment has identified the most common presentations of dental morbidity as broken or lost restorations, pulpitis or periapical abscesses, pericoronitis, acute periodontal conditions (for example, periodontal abscesses/necrotising ulcerative gingivitis) and fractured/chipped teeth, respectively.²⁵ Of note, UKAF personnel with low dental disease experience have been found to be at reduced risk of becoming a dental casualty, emphasising the importance of proactive preventive and interventional treatment during the pre-deployment process.^{23,25}

Often, the most significant factor impacting operational capability is not dental DNBI *per se* but the time lost and transport burden in transferring the individual to a location where appropriate treatment can be delivered. Analysis over an 18-month period (May 2011–October 2012) during Operation Herrick demonstrated that 31.0% (278/898) of patients who required emergency dental treatment were operating at locations without a co-located dental team. Of these individuals, 79.1% (220/278) travelled by helicopter and 17.6% (49/278) by road vehicle to access care.² Analysis conducted by the French Military Health Service has also demonstrated the impact that dental morbidity has on operations; it highlighted that dental emergencies accounted for 24.2% of all medical evacuations during Operation Serval in Mali.⁷

To mitigate time lost and limit the risk in service personnel travelling to access dental care, military dental teams may move forward to support the population at risk.^{26,27} This was seen on Operation Herrick to strong effect, where peripatetic military dental clinics visited forward operating bases, saving substantial operational time and reducing risk to life.²⁸ These clinics focus on the stabilisation of dental emergencies to facilitate the return of patients to unrestricted duty for a finite period and are also utilised to identify cases that require to be returned to a support area, co-located with additional medical capability for more complex dental treatment. At sea, dental care is provided by afloat dental teams (consisting of a uniformed dental officer, nurse and hygienist), deployed on board Royal Navy and Royal Fleet Auxiliary vessels. Here, emergency and routine dental care can be delivered to the population at risk while avoiding disruption to the vessel's operational commitments. While the primary clinical role is the delivery of dental care to the deployed force, military dental teams also undertake medical leadership roles while on operations; for example, planning and enacting major medical incident response management.

In addition to healthcare support of the force during operations, deployed dental capability is utilised to wider effect. Defence dentistry has forensic dental identification capability, and the Dental Identification Team (DIT) forms part of the deployed capabilities held at readiness for activation in support of UK mass casualty incidents and those overseas (especially but not solely on operations where host nation resources and/or jurisdiction is challenged).²⁹ Deployed

dentistry is also a significant asset to Defence Engagement activity, where the provision of dentistry to a host nation population is of immediate and significant benefit to both the patient and strategic influence.

Agile

The agility and flexibility of the uniformed dental workforce is critical to ensure Defence priorities are met. Should a military unit be placed at high readiness to deploy, military dental teams are redistributed across UKAF bases to enable these service personnel to have their treatment needs met before deployment, to minimise the risk of becoming a dental casualty while on operations.

This flexibility to move assets to serve the population has been utilised most recently to enable the rapid setup of regional treatment hubs in the initial response to the COVID-19 pandemic led by military dental teams, with the ability to move uniformed dentists and nurses to cover gaps in service provision. These regional hubs enabled emergency treatment delivery to be maintained and ensured prioritisation of dental care to support deploying personnel to prevent adverse impact to operations.

Legislation implemented in response to the COVID-19 pandemic has caused an unprecedented fall in direct access to dental care, which is likely to have impacted the dental health of the UK population. To address this risk among the UKAF population, dental readiness preparation teams comprising uniformed military dental personnel have been deployed across the UK to implement mobile dental clinics (located in open tents or large ventilated hard standing) to treat military units with high treatment need. This has enabled military units preparing to deploy to be treated while mitigating the impact of nationally mandated fallow time following aerosol generating procedures. In addition, military dental officers have been utilised for their military and system leadership experience, transferable skills in infection prevention and control, clinical care and understanding of primary healthcare to provide command and control in response to the COVID-19 pandemic. Roles have included: leading the Defence Primary Healthcare COVID-19 operations cell; embedding as primary care liaison officers within the MOD, NHS, Public Health England and the logistic supply chain; and undertaking roles within the

national vaccination taskforce. Military dental nurses, as subject matter experts in infection prevention and control, were trained to provide supportive care in COVID-19 bedding down facilities, delivered FFP3 respirator fit testing and oversaw personal protective equipment distribution across UKAF bases.

Holistic

Although operational requirements are critical, an essential component of Defence dentistry delivery focuses on minimising new disease in service personnel as they progress through their military career. When recruits enlist into the UKAF, they often experience significant lifestyle changes. The pace and intensity of military training and exercises, coupled with substantial changes in living, eating and socialising arrangements, can often modify health behaviours including diet, exercise, tobacco and alcohol use, which may impact on their oral health and wider wellbeing. Health promotion is therefore integral to Defence dentistry delivery, which uses a data-driven approach aligned with wider primary care pathways to inform Defence commanders of trends and at-risk groups, and assist development of wider UKAF public health policy.

Defence dentistry has a unique advantage compared to civilian dental services in that all military personnel are occupationally required to undertake routine oral health assessments, ensuring patient contact across the whole UKAF population. This provides a regular opportunity for the reinforcement of key health promotion messaging as part of a common risk factor approach. Oral health promotion tailored to the individual is provided during routine dental care appointments following Department of Health principles by a member of the dental team.³⁰ This includes extended duties dental nurses trained in oral health education and fluoride application to provide targeted preventive advice and treatment to high-risk UKAF personnel. As part of wider health promotion, Defence dentistry has embedded a network of oral health coordinators across the organisation. This group, led predominantly by dental care professionals, plans and coordinates Defence-wide and local campaigns alongside medical primary care colleagues.

The prevalence of smoking among UKAF recruits is estimated to be 36.5%, greater than that of the wider UK population of

Table 4 AUDIT-C question set, scoring system and actions required

AUDIT-C question	Scoring system				
	0	1	2	3	4
How often do you have a drink containing alcohol?	Never	Monthly or less	2 to 4 times per month	2 to 3 times per week	4+ times per week
How many units of alcohol do you drink on a typical day when you are drinking?	0 to 2	3 to 4	5 to 6	7 to 9	10+
How often have you had 6 or more units if female, or 8 or more if male, on a single occasion in the last year?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily
Total score and actions required					
0	No further action required				
1–4	Provision of an alcohol information leaflet wallet card				
5–9	Delivery of an alcohol brief intervention (ABI) and provision of an alcohol information leaflet wallet card				
10–12	Signposting to a primary medical care lifestyles appointment, delivery of an ABI and provision of an alcohol information leaflet wallet card				

14.7%.^{18,31} The relationship between smoking status and socioeconomic background is well documented, and a clear correlation has been observed between smoking at enlistment and both IMD score and educational attainment, with those most likely to smoke in the lowest categories. To address this, smokers are actively engaged as part of routine oral health assessments, with the delivery of 'very brief advice' to provide an opportunity to address their nicotine use, and the comprehensive data collected by Defence dentistry on smoking habits are utilised to inform wider Defence health promotion policy.³²

Alcohol-related harm continues to represent a major public health issue for the UKAF. Evidence suggests that alcohol misuse within the UKAF is higher than the general UK population, with estimates of increased risk drinking levels between 39% and 67% of the military population.^{33,34} The Department of Health and NICE recommend that healthcare professionals utilise alcohol use screening tools and alcohol brief interventions routinely.^{30,35} Therefore, Defence dentistry's access to the whole UKAF population on a regular basis provides a unique opportunity to engage and empower service personnel by implementing the Alcohol Use Disorders Identification Test-Consumption (AUDIT-C) – a three-question tool to help identify, advise and (where appropriate) signpost to support services those patients whose alcohol use may potentially place them at increased risk (Table 4).³⁶

Introduction of the AUDIT-C has seen Defence dentistry successfully deliver a whole-population alcohol initiative as a public health

intervention at scale, promoting positive attitudes towards alcohol use. Analysis of the initial 12 month roll out demonstrated 74% of service personnel completed the AUDIT-C initiative, of which 61% scored 5 or above indicating they may potentially be at increasing or higher risk of alcohol-related harm.³⁷ Work is now ongoing to develop an integrated care pathway with Defence primary care teams and mental health services consistent with NICE management pathways.^{36,38}

Future opportunities

Future opportunities for Defence dentistry in the clinical sphere lie in the development of a managed clinical network of tier 2 practitioners across the UKAF footprint and increased digitisation. This will improve access to referral pathways to ensure UKAF patients receive timely access to complex care, irrespective of where they are based. In the operational context, the increasingly uncertain global landscape continues to emphasise the imperative for a responsive uniformed dental capability that can surge at short notice to meet the needs of Defence.

Conclusion

Defence dentistry blends patient-centred care and occupational focus in balancing the needs of the individual against their operational role. Combined with a holistic preventive ethos and strong clinical leadership, these attributes form the foundations of an agile, deployable workforce that is able to respond to rapidly changing circumstances. These

principles uniquely position Defence dentistry to meet the challenges the UKAF face in the twenty-first century, whether engaging with international partners, responding to the threat of adversaries, supporting efforts against a global pandemic or protecting UK interests around the world.

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Conflict of interest

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