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“Targeting Hand Hygiene to increase the Public Health Resilience in The Norwegian Army”

A Quasi-experimental design

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Foreword

This Master of Public Health (MHP) thesis results from a combination of my part-time studies at The Arctic University of Norway - UiT (2015- 2019), and filling a new position as Chief Veterinary Officer in the Norwegian Army. This engagement has involved working on Force Health Protection (FHP) measures for our soldiers, while based in a military medical service where the main effort has been the implementation of heroic lifesaving concepts such as Tactical Combat Casualty Care (TCCC) and ‘*care under fire*’ (CUF). The focus of attention on individual patients as well as “*the role of the rescuer*” is often a tough match for Public Health (PH), as we generally do not work with identifiable patients, and in giving our PH-recommendations, people may in fact have to sacrifice some of their own individual freedom towards a common good (WHO, 2002; Hope, 2001).

The MPH study-programme has motivated me to try and generate knowledge that may become useful both within the civilian medical- and the military communities. The integration of civilian and military health resources is an important part of the ‘*total defence*’ concept in Norway (Sommerfelt, 2017). In the process I have become acutely aware of some important cultural differences between the civilian and military sectors, and there seems, perhaps for a reason, to be a certain disregard of ‘academics’ in the operational- and tactical level military environment, making much research within the military more difficult. Nevertheless, the military must be in a position to continuously adapt to upcoming threats, and this depends on having access to reliable information on which to base new decisions. Both military and political decision makers have for long realised the importance of having access to good and timely intelligence. High quality intelligence may resemble quality science in that both are seeking ‘*objective reality*’ dividing truth from falsehood (Hayden, 2018), and for this reason I hope this thesis can contribute towards further developing ‘medical intelligence’ in NATO, a novel discipline that has preoccupied me over much of the last decade. I wish to thank the internal and external teaching staff at ISM / UiT for sharing their knowledge, and not least my supervisors, Bjørn Petter Kaltenborn from Norwegian Institute for Nature Research and Einar Kristian Borud from Norwegian Armed Forces Medical Services and UiT for all their guidance, useful remarks, and not the least, patience. Thanks also to Professor Ørian Olsvik and Colonel (Ret.) Per Lausund for inspiration and facilitation.

President Trump: «Nobody Knew Health Care Could Be So Complicated»



“We are buried beneath the weight of information, which is being confused with knowledge; quantity is being confused with abundance and wealth with happiness.

We are monkeys with money and guns...”

Tom Waits

1 Executive Summary

Background

Current security predictions are based on new non-linear hybrid threats with the potential to harm both military and civilian public health (PH). Inadequate hand hygiene practices may increase vulnerability unless resilience can be improved. Handwashing habits are difficult to change but are key to successful decontamination and maintenance of low risk (GREEN) zones the Norwegian Army's operating environment. Medical intelligence, involvement in operational planning processes, and 'nudging' are interdisciplinary approaches suggested as ways forward to promote military and civilian PH.

Materials and Methods

With permission from the Norwegian Defence Force, data on hand hygiene was collected at two different locations. One unit (TMBN) was exposed to an intervention briefing based on the principles of 'nudging', and the unit was observed after a one-week delay comparing pre- and post-intervention results. Collected data was explored for further research opportunities.

Results

The intervention significantly increased mean duration of handwashing with soap and water by almost 33%, and documented a significantly reduced frequency of those failing to wash hands adequately, but also of those making use of hand sanitisers after washing. There was no significant difference between officers and NCOs, or male and female soldiers.

Assessment

Much valuable PH research can be conducted within a military setting, increasing the ability of subject matter experts (SMEs) to influence the decision makers as well as the troops directly. Nudging can be a successful tool for this purpose but needs to be followed up by frequent reports of performance.

2 Introduction

With the current security situation in the World, there is an urgent need to address the gap in knowledge about interventions that can be aimed at reducing the vulnerabilities associated with hybrid threats to public health (PH), in both the military and civilian sector. Predictions from the intelligence services describe hybrid threat scenarios, typically aimed below the thresholds of violence that would trigger a reaction applying North Atlantic Treaty Organisation (NATO)'s collective defence clause, Article V (Etterretningstjenesten, 2018; Shea, 2016). Both NATO and European Union (EU) member states are in the process of responding to these predictions by addressing the need for increased resilience against what they call 'invisible threats', potentially affecting civilian society (Shea, 2016), and the former Norwegian '*total defence*' concept is being restored in an attempt to counter possible elements of hybrid warfare (Justis- og beredskapsdepartementet, 2016; Shea, 2016; Sigrid, Johansen, Carlsson, & Staib, 2017). Hybrid warfare is poorly defined but often described as "*the synchronized use of multiple instruments of power, tailored to specific vulnerabilities across the full spectrum of societal functions*" (Cullen & Reichborn-Kjennerud, 2017). The goal is to achieve synergistic effects, while remaining below obvious detection and response thresholds, and one of the biggest challenges remains to differentiate belligerent action from a more natural 'incidence other than attack', and both detection and protection are matters of public health concern. Merriam-Webster broadly defines PH as: '*the art and science dealing with the protection and improvement of community health by organized community effort and including preventive medicine and sanitary and social science*'.

An article from 2016 featuring Swedish public health professor Hans Rosling, in the journal Nature, describes the current era as 'post-factual' (Maxmen, 2016) and Oxford Dictionary's word of the year 2016, was 'post-truth' (A. Johnson, 2016). Significant amounts of disinformation, e.g. anti-vaccine propaganda or politically motivated lies, are persistently spread on social media platforms, with the messages often being strategically deployed and then subconsciously reinforced. This can be achieved by use of algorithms developed by specialised marketing consultancy firms such as former Cambridge Analytica, and researchers are being reminded to approach the use of such '*Big Data*' with care (Booth, 2018). Both the public in general, as well as politicians and decision makers seem to be highly resistant to any facts that may be challenging our preconceived ideas (Aron, 2019; Rosling, Rosling, & Rönnlund, 2018) and under these circumstances it is important to also have access to scientifically sound, unbiased information, as one otherwise may be at increased risk of

making wrong decisions. An important source such of information bias may be hidden commercial agendas, not least in association with the military, as the stakes are generally high when it comes to winning military contracts. Such forces are likely to come into play also in relation to preventive medicine and public health. The less than clean war of arguments over superior hygiene in relation to hand drying with paper towels vs. air blowers was documented in a recent article in *The Guardian* (Subramanian, 2019), with the contributions from research involved being critically examined. As such the rise in “fake research” is also of concern (Rushby, 2019), and the fast growing jungle of information calls for great precaution when looking for scientific support for an idea. The false evidence claiming links between *mumps, measles & rubella* (MMR) vaccines and autism in children (Wakefield et al., 1998) has been rebuked, but in line with laws of probability, there will be more questionable research out there. This is emphasised in the MPH-curriculum at the Arctic University of Norway and methodology to deal with this challenge is taught in a mandatory course on Health Technology Assessment and Medical decision-making (HEL 3055) (UiT, 2015). Even in the absence of a clear scientific consensus, biased information may easily come to form the opinion of those responsible for procurement or will influence the situational awareness (SA) of military decision makers, and these forces may have contributed to the shift from traditional handwashing with soap and water, toward the use of alcohol-based hand rub (ABHR) sanitiser products both for hospital as well as military field use (Opsahl, M. pers. com., 2019). Also in military garrisons the ABHR have been seen as sufficient, leading to the construction of several large military dining facilities in Norway without dedicated hand washing facilities at the entrance. This happened in spite of the fact that the official recommendations continued to state that handwashing with soap and water was needed if the skin was visibly soiled, and in any case before the intake of food. This has left vulnerabilities that may be exploited if not dealt with, hence there is a need to become more resilient to PH threats, not least within the military sector. For units specialised in the handling of Chemical, Biological, Radiation, Nuclear and Explosive (CBRNE) events, decontamination procedures are second nature, and efficient biological decontamination depends on both mechanical cleaning, usually with soap and water, followed by the application of a suitable disinfectant. This thesis is focusing attention on decontamination of the hands.

The importance of hand hygiene was notably described in 1891 by Hungarian physician Ignaz Phillip Semmelweis who argued that his fellow doctors, who also performed autopsies on the deceased, should start performing routine handwashing with chlorinated water after he

discovered that the maternity ward served by doctors had several times higher mortality than those wards attended by midwives only (Semmelweis, 1891). Instigating the necessary changes proved challenging (Lund, 2006), and even in the 21st century hospitals and public health agencies are grappling with the issue of low compliance to hand hygiene among health care workers (Amin et al., 2019; Cure & Van Enk, 2015; Kampf, Marschall, Eggerstedt, & Ostermeyer, 2010; Naikoba & Hayward, 2001).

Changing someone's behaviour is difficult, and even when doctors document to their buy-pass operated heart patients that upholding only 40 minutes of regular physical exercise will be a matter of life or death, less than 10% were still complying 12 months post-surgery (Gerard, 1993; Undseth, 2015a). When it comes to changing handwashing behaviour, at least one systematic review suggests that a multifaceted approach based largely on 'nudges', such as continuous reminders and feedback of performance, was necessary in order to have a long term effect on hand hygiene habits and associated hospital-acquired infection rates (Naikoba & Hayward, 2001; Roland, Suhrcke, & Kelly, 2011). The concept of 'nudging', introduced in 2008, originated from behavioural economy and was defined as "*any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives.*" (Egan, 2017; Thaler & Sunstein, 2008). This may be worth exploring as a means of attaining the required change of habits in hand decontamination, and hence building PH resilience. The Norwegian Army has several times had to go through major changes and must continuously adapt and improve in order to face up to new threats and challenges (Kristoffersen, 2019). The biggest transformations recently have been the implementation of gender neutral national service to include females born after January 1st 1997, as well as the reintroduction of a non-commissioned officer (NCO)-corps, bringing in sergeants at several levels as a link between the officers and the lower ranks. These are the 'middle management' specialists who are responsible for direct leadership, as well as communicating and executing orders. Both these changes will likely have implications for how best to go about implementing a behavioural change in the Army. A constant threat to soldiers and their operative capability is the possible outbreak of an infectious disease, most commonly contracted through the airborne or faecal-oral routes of transmission. Among several examples (Rognstrand, 2019; VG, 2011), one interesting case took place in Camp Marmal, Mazar e Sharif, Afghanistan in 2006, where as many as 120 Norwegian soldiers were non-operational for several days due to food poisoning with *Shigella sonnei* (Ref. Annex B for details). Such events may be incidental, but could also

theoretically be part of a hybrid attack. Decisive moments in other large scale military interventions, such as “Operation Desert Storm” are said to have been put on hold due to disease outbreaks among key personnel (NN, pers. com.).

The Centers for Disease Control and Prevention (CDC) stated in a recent campaign that handwashing can prevent one in three cases of diarrhoea and one in five respiratory infections (CDC, 2019) and this is supported by several meta-analyses, such as one published by the American Journal of Public Health (Aiello, Coulborn, Perez, & Larson, 2008). The CDC campaign, launched October 15th on the 2019 Global Hand-washing Day, now officially recommends 20 seconds of handwashing with soap and water. Informal data from the Northern Brigade in the Norwegian Army in 2017 suggested an average duration of 7 seconds (Helljesen, pers. com). Several studies link improved handwashing with reduced absenteeism (A-Martinez, 2014; Azor-Martinez et al., 2016; Wang, Lapinski, Quilliam, Jaykus, & Fraser, 2017; White et al., 2003), suggesting that increased focus on hand hygiene may reduce important vulnerabilities as well as improve fighting strength in combat units. Statistical analysis of unpublished data from Operation Inherent Resolve (OIR) in Iraq, informally gathered in response to internal claims from Norwegian soldiers that allied troops were having much poorer hand hygiene than those from Norway (see Annex A), suggested that officers and men from the Norwegian Army, when on live missions abroad, spent an average of close to 15 seconds handwashing, suggesting an increased handwashing duration when compared to home base. The accusations toward fellow nations were found to be exaggerated and largely unfounded. There were however some interesting differences between the various units surveyed and the complaining unit, the Telemark Battalion (TMBN), were surpassed both by other Norwegian units as well as other nations.

The applied research in this thesis is aimed at contributing towards the development of practical methods that may reduce vulnerability, by generating sound data and scientifically based concepts to allow vetting of our preconceived notions. By obtaining permits to access parts of the Norwegian Army, sufficient anonymous data will be generated in order to learn more about hygiene behaviour and how behavioural change can be instigated based on targeting hand hygiene, using a chosen strategy. Procedures that are habitual are difficult to influence and traditional regulation may have insufficient effect. The concept of nudging may be worth exploring as a means of achieving the required habits in hand decontamination, and in hence building public health resilience.

This will be achieved by generating baseline data and then running an intervention on a selected unit, comparing the pre-intervention results with post-intervention results. This research seeks to analyse hand hygiene habits in the Norwegian Army and investigate how they may be influenced through an intervention. Focusing on this question through scientific methodology will help decision makers spend resources more efficiently, preserving fighting strength and high readiness, while at the same time reducing vulnerabilities against hybrid threats. I hypothesise that a soft intervention based on ‘nudging’ will have a significant effect on the hand hygiene of soldiers in the Norwegian Army. Additionally, I will conduct exploratory analyses of the generated data sets in order to identify further opportunity for research.

3 Materials and Methods

The data collection was conducted in two stages. The first one was a pilot study conducted in June, 2018, at Setermoen Military Camp, in order to obtain baseline information and test the methodology. The initial data collected included the following variables: Handwashing duration (using stopwatch without recording start and stop times), Rank, Military Unit and Sex. At this facility there was also a separate entrance for private soldiers (conscripts) and officers, however, on the conscript side it was not possible to conduct the collection without arousing suspicion from the soldiers as this side daily has up to four duty officers lined up to check that everyone actually washes their hands. They are instructed to send people back if they try to go past without washing. The same duty officers were now tasked, working in teams, to time and make note of handwashing durations, something that was hard to conceal, particularly from those soldiers waiting in line. This data may nevertheless provide insight into the effects of traditional regulation vs. nudging, as such coerciveness was absent on the officers’ side, and here the timing of handwashing duration was done discretely.

The method used for the main body of research was a between groups intervention study with a pretest - posttest quasi-experimental design. There was no control group and true random assignment was difficult to achieve. Quasi-experiments can nevertheless be useful to evaluate effectiveness of an educational intervention under field conditions (Price, P. C., Jhangiani, R., & Chiang, 2018).

Data for the main experiment was collected during February, 2019, followed by the intervention, which consisted of a 45 min plenary session on May 13th, 2019. Here the whole test unit was invited to attend a briefing on a suggested new hygiene concept for the Army. The intervention briefing was designed to expose the test unit to at least four out of six active ‘nudging’ ingredients as suggested by a team from Massachusetts Institute of Technology (MIT) (Grenny, Maxfield, & Shimberg, 2008). They are: 1. Link to mission, vision and values. 2. Over-invest in capacity building. 3. Increase peer pressure. 4. Create social support. 5. Adjust reward systems and ensure responsibility (rules). 6. Change the surroundings (Undseth, 2015b). Exact details of this nudge-briefing are outlined in Annex C.

Post-nudge data was collected after a one-week delay, starting on May 20th, 2019. Care was taken to conduct the data collection pre- and post-intervention in a clandestine fashion (Devine, 2019), as to avoid announcing the activity or otherwise influencing the behaviour under observation, such as seen with the Hawthorne observer effect (Srigley, Furness, Baker, & Gardam, 2014). Only the camp and unit commanders were pre-informed by necessity as part of applying for the research permit, but were specifically advised not to inform in their line of command so as to influence the results. The kitchen staff at the dining facility (DIFAC) were informed on the morning of first collection day, in order to request access to facilities and prevent rumours from building up. Three parameters were selected for measuring hand hygiene, with main focus being on the time duration spent washing hands. The other observations recorded were; use or no use of hand sanitiser and; one of three options for hand drying. These included using disposable paper towel, whether hands were simply air dried, or whether hands were wiped dry on trousers / other unclean surface. Both data collection sites have one entrance for the lower ranks (conscripted soldiers) and one for those employed in the army (professional soldiers, NCOs and officers). Those on the employee side are required to make payments at a card terminal that opens a revolving gate before accessing the dining hall. After this there are dispensers available containing ABHR for sanitising the hands.

Hand wash duration was recorded by trained observers who worked in pairs. In order to avoid influencing the behaviour to be observed, the observations were made from a safe distance, seated at a dining table inside the DIFAC with an oblique view towards the area where the handwashing queue lined up. The observers were thus seemingly preoccupied with their mobile phones, or chatting while having their meal. Using an add free smartphone application showing the time on a highly visible full screen display clock (Andreas1724, 2017), the

observers discretely noted the start- and stop time of handwashing of the subject, who was then followed closely in order to make note of hand drying technique, sex, rank and unit, as well as whether they used the hand sanitisers available. Only after this was a new 'random' unsuspecting subject put under observation. This was to secure more independent results, as two people washing next to each other will easily influence each other. Start time was defined as when the automatic hands-free faucet opened, and stop was defined as when the subjects clearly had removed themselves away from the washbasin or grabbed hold of paper towels for hand drying. The facility had eight Oras Washbasin faucet model Electra 6250F (ORAS GROUP Isometsäntie 2, P.O. Box 40 FI-26101 Rauma Finland) installed, with standard factory settings.

The following information was written on the data collection forms in addition to time at start and stop of handwash: *Sex, Rank, Unit, air-drying technique and whether or not sanitiser (ABHR) was used*. This dataset also generated information on how many who did not wash their hands (handwashing duration = 0 seconds).

3.1 Study population

Both pilot and intervention study was conducted on members of the Norwegian Army, comprising both genders, with ages lying between 18 and 59 years. The pilot was conducted at Setermoen Garrison in the North of Norway in what are mainly conscript-based support- and manoeuvre units of the Army's Brigade NORTH. Here the typical soldier is between 18 and 25 years of age and the sex ratio is an estimated 75/25 male to female with the majority being between 18 and 20 years of age. The population in the intervention study, the Telemark Battalion (TMBN), a 480 person strong elite mechanised infantry unit consists 100 % of professional full-time soldiers who have been through additional and comparatively tough selection processes and training. They are located to the South of Norway at Rena Garrison and currently in this unit the age ranges from 19 to 58 years. The mean age is 26, and 35/480 (7,3%) are women. (Thea Hellebergshaugen, Ass S-1, pers. com).

3.2 Statistical analysis

Given the limitations of this applied research setting, thus affecting the experimental design, the identification of the most suitable statistical analysis has been challenging. With the main

dependable, or 'outcome'-variable, being continuous (duration measured in seconds of handwashing), comparing means was possible using a t-test. However, this requires that a number of assumptions are fulfilled. Two more of the dependent variables were typically dichotomous, i.e. handwash / no-handwash (for those with handwash duration = 0), and also use / no-use of ABHR (for sanitising the hands). Two different t-tests should be considered but since the paired-sample t-test requires individual identification to be sure the same individuals are tested before and after the intervention, the independent sample t-test seemed like the best option in this case. Since the data from the test unit lacked normal distribution the non-parametric equivalent, the Mann-Whitney U test was used. Cross-tabulation and a Chi-Square test of independence was used to analyse the relationship between the dichotomous outcomes and the nudging-intervention. The statistical software package used was SPSS 26 Windows (IBM, 2018).

3.3 Theoretical framework

The purpose of both handwashing with soap and water and the correct use of ABHR is to remove the transient microbial flora from the skin surface of the hands, preferably without challenging the protective integrity of the skin, disrupting the normal hand skin microbiome. This can be done with a suitable hand rubbing technique such as the 3- and slightly superior 6 step techniques (Reilly et al., 2016), recommended by the CDC and WHO respectively. It is transient flora that usually makes people sick. The difference between transient and resident microbes on hands may vary, and what is considered the normal microbiome also depends on the frequency with which hands are washed during a shift and how long ago they were washed (Edmonds-Wilson, Nurinova, Zapka, Fierer, & Wilson, 2015). For the purposes of this study, a new 3x5x/6-step technique, based on WHO-recommendations, modified for a military setting, was taught as part of the nudging brief (See Annex C).

Based on the theories of Geoffrey Rose (Rose, Khaw, & Marmot, 2009), which state that *many persons at a small risk, may give rise to more disease than a few persons at high risk*, this project follows the population-strategy of prevention, taking the view that the military needs Rose's help to shift some of their priorities away from the already sickened, high-risk individuals, embracing the population approach instead. In order to understand how the data

generated may play into the military decision making process the following background information is thought to be of interest.

The theoretical framework is based on Norway's equivalent of the NATO document AJMedP-1, describing the Comprehensive Operational Planning Directive (COPD), called Stabshåndbok for Hæren (Sjef Hærens Våpenskole, 2015), and the simplified version written specifically for the medical & veterinary services of the Norwegian Army (Sjef Hærens Våpenskole, 2018). At the core of the military profession is operational planning, ideally achieved by following a small number of rather complex steps and several integrated processes (Christensson, 2016; Vinje, 2007). One such integrated process of particular importance is the concurrent Intelligence Preparation of the Operating Environment (IPOE). Intelligence outputs must be timely, actionable and should have an element of prediction. Furthermore they must be carefully and timely presented in order to maintain usefulness in spite of the constant risk of being wrong (Wiik, Kaltenborn, & Lausund, 2017). The military is traditionally hierarchical with the commanding officer taking the full responsibility for his or her troops. Military advantage and initiative can be won by the commander taking calculated risks. At the same time exposing one's troops to unnecessary risk is not acceptable, as risk control and prevention is often quite possible to achieve (Sjef Hærens Våpenskole, 2015). One normally differentiates between risk to mission, and risk to personnel. Many health risks may in fact jeopardise both mission and personnel (NATO, 2015), and to assure successful prevention, knowing about them is a critical first step. As these risks may vary with different scenarios, they may not always be sufficiently understood or prioritised by the commander. This may be particularly true in situations where many other valid concerns compete for the attention of the decision makers. The military decision making process can be highly efficient and has in the past served well as a tool for complex problem solving within a limited timeframe, at strategic, as well as operational and tactical levels (Vinje, 2007). Nevertheless, the whole process typically relies only on the expert opinion from a small number of subject matter experts (SME), if at all available, and because of the complexity and speed with which changes currently occur, operational planning is likely to become increasingly vulnerable to preconceived ideas. Medical (& Veterinary) Services must therefore contribute to the decision making process and perform their function in an evidence-based manner to ensure that their inputs are relevant to the current situation. Roles to be played in the process could be as planning officers, intelligence analysts or SME's. These all have different entry points when it comes to influencing the decisions to be made,

and all are in internal competition for the commander's attention. Once the decision is made, the commander is sovereign, and may not be in a position to reconsider what are often minor details. For this reason, even pointing to legislative or political arguments in support of any one solution may be counterproductive, as many such concerns could be invalid or may be set aside when a crisis is looming. When regulation is set aside, to medical personnel in particular, nudging people into voluntary compliance may be the only option.

The encouragement of adherence to favourable behaviour patterns in the military has traditionally been by way of a hard "paternalistic" approach introducing numerous laws and legally binding instructions (Det Militære Tidsskrifts Redaktion, 1833). Even if Norway's Army has its own traditions of using orders and regulations, methods based on fear and retaliation were more explicit in king Frederick the Great's 18th-century Prussian Army, where the troops' blind obedience was enforced through draconian discipline, and the soldiers feared their own officers more than they did the enemy (Leebaert & van Creveld, 1985). In Norway a dramatic incident in 1986 (Veum & Hotvedt, 2016), where 16 young soldiers tragically died in an avalanche in Vassdalen near Narvik, led in this country to a change in the way orders from superiors were to be obeyed. There is now a duty to refrain if you see that the order given is clearly wrong, similar to the way nurses must double check on treatment orders prescribed by a doctor. In the military there has been a development towards so called "*auftragstaktik*", or mission command (Shamir, 2011), where junior officers are given much more freedom in how they choose to solve complex tasks in the field, as long as they all follow the Commander's intent (Vinje, 2007). This intent is developed through a complex five step operational planning process (OPP) and in relation to step three, one of the outputs before starting the targeting cycle, involving both the planners and intelligence operatives, is identifying the *centre of gravity* (CoG), defined as "the primary entity that possesses the inherent capability to achieve the objective" (Eikmeier, 2010). Targeting may just as well be non-kinetic, by e.g. distributing propaganda leaflets, food or medical aid in psychological counterinsurgency operations designed to win the 'hearts and minds' of a population, a concept that may bear resemblance to "nudging" vs. hard interventions. When it comes to faecal-oral-, and in some cases also respiratory- disease transmission this thesis argues that *hand hygiene* among our troops is a centre of gravity, and important to be able to influence.

3.3.1 Conceptual framework

A concept central to this paper is a modified model of the relationships between Health services, Health and Utility (Olsen, 2017). Utility is replaced with *Fighting strength*, which includes the combined measure of *Firepower* (Kampkraft), in war something almost parallel to Jeremy Bentham’s *principle of Utility*. It represents a combination of strengths and vulnerabilities, including qualitative aspects such as leadership and morale. Of special interest is the pathway from Medical and Veterinary services to Health. According to military doctrine the mandate of the Military Health Services (MHS) is to *secure and restore* health in order to conserve *fighting strength*, and due to the propensity of these medical services to put almost all their efforts into restoring health, it would be timely to ask exactly how much firepower these efforts generate? With a more holistic approach, *Health* includes more than absence of disease and a state of physical wellbeing, and this paper suggests that in modern warfare, psychological factors and *morale* may be becoming increasingly important. Furthermore, as physical damage is often highly visible, and hence be more likely to trigger a concerted NATO response, ‘invisible’ hybrid threats are much more probable, weakening the psychological factors and decreasing morale. Typically, low but grinding levels of gastrointestinal (GI)-discomfort may be highly efficient at this, not the least in combination with the inevitable chaotic confusion, known as the *fog of war* (Boyce, 2015). Currently with undeserved low status, the main responsibility for preventive medicine is bestowed on the veterinary services.

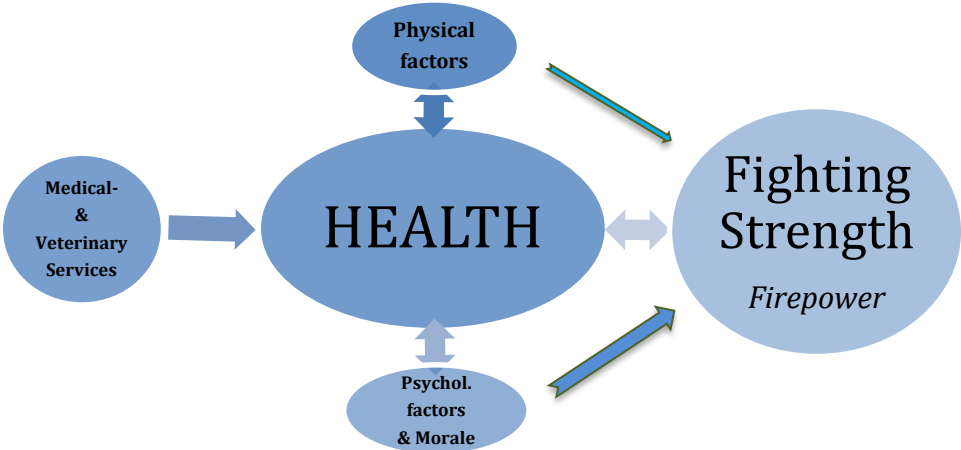


Figure 1 – Concept diagram showing the relationship between Military Health (Medical & Veterinary) Services, Health and Fighting strength. Modified with permission from original figure 1.3 illustrating the instrumental nature of health care - and of health (Olsen, 2017).

The Medical Services have been steadily developing the capacity to restore health, priding ourselves in upholding close to civilian-, state-of-the-art healthcare standards. According to doctrine the argumentation for this resource use is that it is vital in order to uphold the soldiers' willingness to fight. It is not known whether there is data to support this assumption. Such healthcare services were hardly available to members of the sabotage group '*Oslo-gjengen*' in an occupied Norway during the last world war (Manus, 1979). It is likely that it is important for morale, but other factors, such as *glorification of history* has been established as one of the most important factors (Páez, Liu, Bobowik, Basabe, & Hanke, 2016). Hence, if conservation of fighting strength is a priority, more effort should perhaps be put on prevention of injury and disease.

3.4 Ethical considerations

There are several ethical considerations to be had even if the data should be anonymous and the topic of hand hygiene not very controversial. It will always be regarded sensitive when information about military vulnerabilities is made publicly available, however, a strictly scientific perspective aimed at improving health in general, tips the balance in favour of openness. Making research findings available, whether the results are positive or negative, is important in order to make progress. Certain civilian professions may experience ethical dilemmas when drawn into a situation where they make contributions towards enhancement of the Military, often facing criticism from peers (Tone Danielsen, pers. com.). This would be a question of personal belief and conscience, however, the Laws of Armed Conflict (LOAC), especially the Geneva Conventions of 1949, dictate that medical personnel need to take particular care, as they are given *protected status* in conflicts but must at the same time "*refrain from acts harmful to the enemy*". Enhancement of own forces through medical knowledge may be seen as "an act harmful to the enemy", and this issue comprises also other ethical challenges (Mehlman, 2019). However, preventive medicine is considered universally acceptable and will not constitute a breach of international humanitarian law (ICRC, 1949).

The concept of nudging, although increasingly common, and with new nudges generally only replacing old ones, it does raise some important ethical concerns. Nudges may be unhealthy and often have a powerful impact, sometimes with unintended adverse consequences. They should therefore be used carefully and monitored for effect. Sunstein also emphasises that

they must always be overt, transparent and open to scrutiny, preserving full freedom of choice (Sunstein, 2014).

Collecting only anonymous data has been important in this project, as new EU General Data Protection Regulations (GDPR), 2016) and operational security concerns would otherwise have been prohibitive. On the other hand, the information available in the raw data files may be sufficient to narrow down a subject to a very small number of possible identities, and this is of concern, requiring careful handling and destruction of such files. There were also concerns that the option of obtaining initial individual consent would have introduced biases such the Hawthorne effect (Adair, 1984). In spite of not having obtained direct informed consent from subjects, and due to the fact that ‘nudging’ towards improved hand hygiene is not considered a potentially harmful treatment, we conclude that this research has been conducted in accordance with the Helsinki Declaration (“Declaration of Helsinki (1964),” 1996). The author has received no funding and declares no conflict of interest, apart from being employed as a veterinary officer in the Norwegian Army.

3.4.1 Permissions

Conducting data collection in the Norwegian Armed Forces for research purposes requires a special permission granted by Forsvarets Høyskole (FHS). Permission 2019/006169-002/FORSVARET/919 with extension till 31.12.2019 was granted. As a basis for this mandatory research permit, written consent from the camp / unit commanders was a prerequisite.

4 Results

The first part of this section presents the results testing the hypothesis, where the null-hypothesis (H_0) is that the mean handwashing duration remains the same one week after the nudge-intervention as it was before the intervention. The second part of the section explores the baseline data for potentially interesting findings with a view to further research opportunities.

4.1 'Nudge'-response of the Test Unit (TMBN)

In order to answer whether or not the 'nudge'-intervention worked, handwashing durations before and after the intervention are compared using an independent samples t-test. The dependent variable is the handwashing duration and the independent variable is whether the participant was tested before or after the 'nudge'-intervention was implemented. Initially, assumption checks must be performed to assess whether or not the data is appropriate for an independent samples t-test:

The data has a continuous dependent variable (handwashing duration in seconds), and therefore does not violate the first assumption. Further, the data has two categorical independent variables, namely 'nudge' vs. 'no nudge'. Thirdly, the independent samples t-test assumes independence of observations. This is questionable and will be further dealt with under limitations in the discussions section (Chapter 5). The fourth assumption requires of the data that there should be no significant outliers. SPSS calculated a 5 % trimmed mean ($M = 7.95$) removing the top and bottom 5 per cent of cases before a new mean is calculated. When comparing the original mean ($M = 8.83$) to the 5% mean there is a difference. The top and bottom values constituting the extremes in the data set are skewing the data. Nevertheless, they are not considered unlikely values, and are therefore kept on for further analyses. A fifth assumption of the independent samples t-test requires the dependent variable, in this case handwashing durations, to be approximately normally distributed. The skew of the data can give us an impression of its normality. From the *Descriptives* table we can see that the data seems to be positively skewed ($Skew = 4.22$), suggesting that data points are more clustered around the lower end of the scale. People had a tendency to spend a shorter amount of time washing their hands in general. This is visualised in the histogram and boxplot below. A Shapiro-Wilks test was also conducted to assess normality. The hand washing time duration, $W = .69, p < .001$, was significantly non-normal. However, as t-tests are known to

be robust to violations of normality (Edgell & Noon, 1984), this may not have to exclude any options. The final assumption is that there should be homogeneity of variances. To assess this a Levene's test was conducted. For the handwashing durations, the variances were significantly different in the pre- and post-nudge group, $F(1, 850) = 7.64, p = .006$. This means the current data violates the assumption of homogeneity of variance.

Because the data violates assumptions of normality and homogeneity of variance, a non-parametric equivalent of the independent samples t-test is conducted, namely the Mann-Whitney U test. The ranks table shows that the post 'nudge' group had higher handwashing durations than in the pre 'nudge' group, based on the mean rank. The Mann-Whitney test indicated that the handwashing time duration was greater for the post 'nudge' group ($M = 470.47$) than for the pre 'nudge' group ($M = 365.14$), $U = 72494.50, p < .001$. Effect size was calculated by dividing the absolute (positive) standardised test statistic ($Z = -5.069$) by the square root of the number of pairs ($n = 852$). The effect size is $r = 0.17$, which is a small effect (Field, 2013).

Man-Whitney Test: Ranks

	duration prepost-nudge	N	Mean Rank	Sum of Ranks
Handwash duration	prenudge	439	385.14	169074.50
	postnudge	413	470.47	194303.50
	Total	852		

a) Only part of cases with the value 0 are shown in the table of lower extremes

Extreme Values

			Case Number	identification	Value
Handwash duration	Highest	1	429	.	88
		2	326	320	76
		3	807	.	73
		4	430	.	72
		5	431	.	68
	Lowest	1	852	83	0
		2	851	.	0
		3	848	52	0
		4	839	12	0
		5	823	.	0 ^a

Tables 1&2: Ranked sums replace the continuous outcome data to achieve normal distribution.

Descriptives

		Statistic	Std. Error	
Handwash duration	Mean	8.83	.282	
	95% Confidence Interval for Mean	Lower Bound	8.27	
		Upper Bound	9.38	
	5% Trimmed Mean	7.95		
	Median	7.00		
	Variance	67.521		
	Std. Deviation	8.217		
	Minimum	0		
	Maximum	88		
	Range	88		
	Interquartile Range	7		
	Skewness	4.218	.084	
	Kurtosis	29.333	.167	

Table 2: Descriptive statistics of mean and trimmed mean as well as skewness, which indicates non-parametric data.

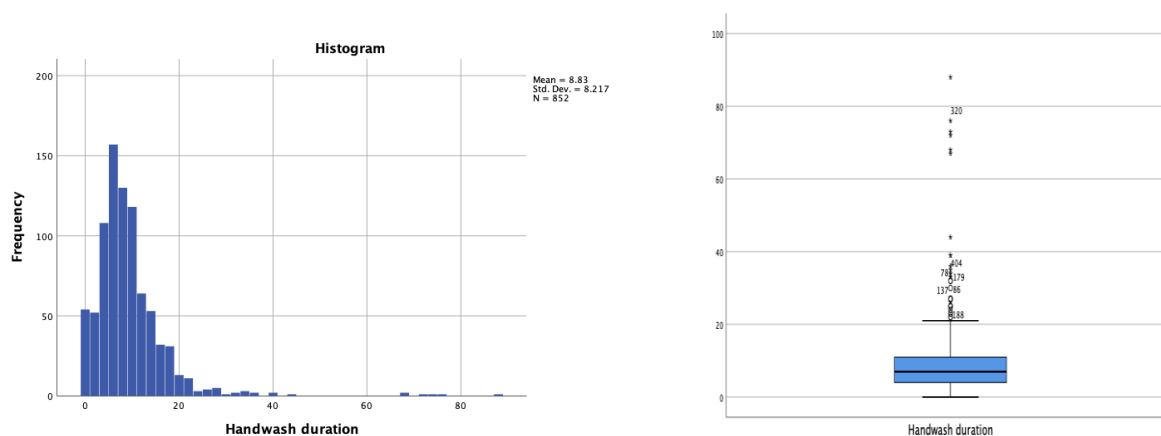


Table 3 Histogram and boxplot showing the clustering of data points around lower end of scale (positive skew), thus violating the assumptions of normality.

4.1.1 Wash vs no-wash

A Chi-Square test of independence was used to investigate if there is a relationship between the implementation of ‘nudging’ and whether or not people washed their hands at all (i.e. if handwashing duration = 0 seconds). Similarly, the relationship between ‘nudging’ and use or no use of hand disinfection was tested.

The following is hypothesised for handwashing behaviour;

H_0 : Nudging is independent of handwashing.

H_1 : Nudging is not independent of handwashing.

Nudging * Handwashing Crosstabulation

Count		Handwashing		Total
		No wash	Wash	
Nudging	prenudge	42	397	439
	postnudge	12	401	413
Total		54	798	852

Table 4: Cross-tabulation between nudging and handwashing allowing calculation of odds ratios (OR)

The Pearson's Chi-square test indicated a significant association between having received the 'nudging' and whether or not people washed their hands $\chi^2 (1) = 15.91, p < .001$. Based on the odds ratio (OR), the odds of people washing their hands was 3.54 (33.42, 9.45) times higher if they were in the group that received 'nudging' than if they were not.

4.1.2 Hand disinfection before and after 'nudge'-intervention

Secondly, a chi square test of independence was used to investigate the association between the tendency to use disinfection after washing hands and whether or not they were in the pre- or post-nudge group. The following is hypothesised for the usage of disinfection;

H_0 : Nudging is independent of disinfection.

H_1 : Nudging is not independent of disinfection.

Nudging * sanitiser use Crosstabulation

Count		sanitiser use		Total
		0	1	
Nudging	prenudge	209	228	437
	postnudge	256	156	412
Total		465	384	849

Table 5: Cross-tabulation between nudging and disinfection using an ABHR hand sanitiser.

The Pearson's Chi-square test indicated a significant association between having received the 'nudging' and whether or not people sanitised their hands $\chi^2(1) = 17.53, p < .001$. Opposite to the results for handwashing behaviour, the odds of people using sanitiser was 1.78 (1.64, 0.92) times higher if they were in the group that did not receive 'nudging' than if they were.

4.2 Exploratory baseline data (handwash duration)

Baseline data collected at Setermoen Garrison dining facility in June 2018 yielded a total of 493 handwash duration records. Mean handwashing duration was 9,23 seconds with a standard deviation of 4,991 seconds. The durations ranged from 0 to 40 seconds with only one person failing to wash hands (a 0 second handwash) and a further 19 soldiers spending three seconds or less. The 25th and 50th quartile averaged 6,00 and 8,00 seconds respectively.

N	Valid	493
	Missing	0
Mean		9,23
Std. Deviation		4,991
Minimum		0
Maximum		40
Percentiles	25	6,00
	50	8,00
	75	11,00

4.2.1 Unit-wise comparison between Officers and Privates

Mean handwash durations ranged from 8,37 seconds (privates with missing data (n=198)) to 16,67 seconds (officers from the Intelligence E (n=3)). The difference between Officers ≥ 1 and Private soldiers < 1 are listed for each unit: 1 is the Intelligence Battalion, 2 is Medical Battalion, 3 is the Armoured Battalion (similar function to TMBN) and 4 is Artillery.

Group Statistics

Military Unit (Int. Med, Arm, Art)	Military Rank (P, OR, NCO, Officer)	N	Mean	Std. Deviation	Std. Error Mean
1 E	≥ 1	3	16,67	11,240	6,489
	< 1	7	9,43	5,255	1,986
2 S	≥ 1	5	13,40	8,081	3,614
	< 1	71	8,86	3,231	0,383
3 P	≥ 1	22	11,32	3,747	0,799
	< 1	88	8,77	4,039	0,431
4 A	≥ 1	8	13,38	5,780	2,044
	< 1	44	8,64	4,081	0,615
99 Missing	≥ 1	10	13,20	8,917	2,820
	< 1	198	8,37	4,720	0,335

Table 6: Baseline data with mean handwash durations for Officers (≥ 1) and Private soldiers (< 1) The Units are: 1 = Intelligence Battalion, 2 = Medical Battalion, 3 = Armoured Battalion, 4 = Artillery Battalion

4.2.2 Gender comparison

The female soldiers (n=81) had a mean handwashing duration of 9.63 seconds and the males (n=225) 9.80 seconds. The handwashing duration of the males had a larger range (33 vs. 29 seconds) and a larger standard deviation (5,157 vs 4,737 seconds). The table below shows group statistics for male and female members of each of the units at Setermoen with p-values only $p = .206$ and above. Furthermore, all the 95% Confidence Intervals (CI) cover 1, rendering none of these findings statistically significant.

Descriptive Statistics

Gender		N	Minimum	Maximum	Mean	Std. Deviation
1 M	Hand washing duration (sec)	225	2	35	9,80	5,157
	Valid N (listwise)	225				
2 F	Hand washing duration (sec)	81	0	29	9,63	4,737
	Valid N (listwise)	81				
99 Missing	Hand washing duration (sec)	187	3	40	8,37	4,796
	Valid N (listwise)	187				

Group Statistics

Military Unit (Int. Med, Arm, Art)	Gender	N	Mean	Std. Deviation	Std. Error Mean	
1 E	Hand washing duration (sec)	1 M	5	8,00	3,937	1,761
		2 F	7	13,00	8,505	3,215
2 S	Hand washing duration (sec)	1 M	40	9,38	4,413	0,698
		2 F	39	8,85	3,337	0,534
3 P	Hand washing duration (sec)	1 M	95	9,34	4,049	0,415
		2 F	21	8,76	3,897	0,851
4 A	Hand washing duration (sec)	1 M	49	9,76	5,585	0,798
		2 F	4	10,25	5,965	2,983
99 Missing	Hand washing duration (sec)	1 M	36	11,81	7,387	1,231
		2 F	10	11,90	6,280	1,986

Independent Samples Test

Military Unit (Int. Med, Arm, Art)			Levene's Test for Equality of Variances		t-test for Equality of Means						
			F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
										Lower	Upper
1 E	Hand washing duration (sec)	Equal variances assumed	3,078	0,110	-1,212	10	0,253	-5,000	4,124	-14,188	4,188
		Equal variances not assumed			-1,364	8,934	0,206	-5,000	3,665	-13,301	3,301
2 S	Hand washing duration (sec)	Equal variances assumed	2,273	0,136	0,600	77	0,550	0,529	0,882	-1,227	2,285
		Equal variances not assumed			0,602	72,549	0,549	0,529	0,879	-1,223	2,280
3 P	Hand washing duration (sec)	Equal variances assumed	0,069	0,793	0,593	114	0,555	0,575	0,970	-1,347	2,497
		Equal variances not assumed			0,607	30,315	0,548	0,575	0,947	-1,357	2,507
4 A	Hand washing duration (sec)	Equal variances assumed	0,088	0,768	-0,170	51	0,866	-0,495	2,916	-6,349	5,359
		Equal variances not assumed			-0,160	3,444	0,882	-0,495	3,087	-9,642	8,652
99 Missing	Hand washing duration (sec)	Equal variances assumed	0,182	0,672	-0,037	44	0,971	-0,094	2,564	-5,263	5,074
		Equal variances not assumed			-0,040	16,616	0,968	-0,094	2,336	-5,033	4,844

Table 7: Tables showing descriptive and group statistics with the difference between mean handwashing durations for male and female members of each unit. None of these differences are statistically significant.

4.2.3 Adjusted odds ratio for (theoretical) handwash failure

Results for the new outcome *handwash failure* emanating from the discussion under section 5.5 are presented below. This outcome was established after adjusting for a theoretical risk exposure curve (**Feil! Fant ikke referansekilden.**), where simply wetting the hands (handwash durations of 2 seconds or less) is considered a risk equivalent, or higher, than not washing hands, hence constituting handwash failure. The Pearson's Chi-square test still indicated a significant association between having received the nudging and whether or not people failed with washing their hands adequately $\chi^2 (1) = 16.21, p < .001$. Based on the odds ratio, the odds of people washing their hands was 2.42 (11.91, 4.93) times higher, if they were in the group that received nudging than if they were not.

*duration prepost-nudge * Handwash-failure Crosstabulation*
Count

		Handwash failure		Total
		0	1	
Dur prepost-nudge	1 prenudge	74	365	439
	2 postnudge	32	381	413
Total		106	746	852

Table 8: Crosstabulation between nudging and non-adequate handwashing (Handwash failure).

Chi-Square Tests

	Value	df	Asymptotic		
			Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	16,206 ^a	1	0,000		
Continuity Correction ^b	15,381	1	0,000		
Likelihood Ratio	16,656	1	0,000		
Fisher's Exact Test				0,000	0,000
Linear-by-Linear Association	16,187	1	0,000		
N of Valid Cases	852				

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 51,38.

b. Computed only for a 2x2 table

Table 9: Chi-Square test statistic results indicating a significant association between nudge exposure and adequate handwashing

Finally, the pre- and post 'nudge' data was used to look for differences between officers, and the newly established corps of NCOs. For Officers the odds ratio for washing their hands were calculated to 6.34 (24.00, 3.67) times higher if they were in the group that received 'nudging' than if they were not. For NCOs the odds ratio for washing their hands was 6.92 (139.00, 20.10) times higher if they were in the group that had received 'nudging' than if they were not.

*duration prepost-nudge * WashNOWash Crosstabulation*

		Count			
Handwashing		No	Yes		
NCO	Intervention	1 prenudge	9	188	197
		2 postnudge	2	278	280
	Total		11	466	477
Handwashing					
CO	Officers	1 prenudge	15	55	70
		2 postnudge	1	24	25
	Total		16	79	95

Table 10: Showing the cross-tabulation between nudging and handwashing, comparing commissioned and non-commissioned officers (NCOs).

5 Discussion

This thesis has established baseline information about hand hygiene habits in units from the Norwegian Army. Furthermore, the research has demonstrated that an intervention based on nudging can have a significant effect on the duration of handwashing in one professional unit in the Army. Also the group exposed to the 'nudge'-intervention, was several times (2.4 – 3.5) more likely to wash hands when compared with the group not exposed. The opposite was true with regard to the use of hand sanitisers after washing hands, although the odds for not using sanitiser were weaker 1.78 (1.64, 0.92) and not significant. This could be explained by the fact that the nudging brief promoted soap and water as the method of choice, leaving hand sanitiser use optional. Finally, the study indicated that Officers and NCOs were in excess of 6 times more likely to wash hands one week after the intervention than they were before the

intervention. Due to incomplete data on the lower ranks, we do not have exact results but since the overall improvement in handwashing compliance was lower (Odds Ratio: 2.4 – 3.5) than among groups of the officers (commissioned and non-commissioned), this could indicate that the lower ranks were the most difficult to influence. This is also supported by the generally lower mean handwashing durations among lower ranks in the baseline data in Table 6. Nevertheless, this study has several important weaknesses and limitations which are discussed step by step below.

5.1 Targeting hand hygiene

The military may be more vulnerable than necessary due to a general disinterest in generating certain types of data, and decision making processes can thus be easily influenced by dis-information and preconceived ideas. By identifying hand hygiene as the *centre of gravity* for public health resilience, this research was aimed at providing sound data on hand washing behaviour and how it could be influenced. Conducting applied research within a military environment means having to adapt and compromise all the time, yielding data that in spite of being rare and hence valuable, will often have some flaws. At first eyesight the results looked impressive as an independent sample t-test was simply used to measure the difference in handwashing duration before and after the nudging intervention. The 7.7 sec. handwashing duration of TMBN before (n=250) the intervention (Mean= 7.72 SD=6.666) increased to 10.2 sec. after (n=412) the intervention (Mean= 10.24 SD=9.660). This represented an increase of almost 33%. The standard deviations were very large, and as discussed in the next section on violation of statistical assumptions, this may have given an overly optimistic impression of the ability to influence hand hygiene in the Army. Nevertheless, the null-hypothesis (H_0) which suggested that parameters measuring hand hygiene will remain the same after the intervention, did not stand up to the test, even when applying the non-parametric method in 4.1, and was discarded. By applying the most relevant statistical technique, a small but still significant effect was seen after the intervention. H_0 was therefore rejected in favour of the alternative hypothesis H_A , suggesting that a soft intervention based on ‘nudging’ will have a significant effect on the hand hygiene of soldiers in the Norwegian Army. This, however, does not prove that the nudging was the cause of this effect, and due to the many limitations of this study-design, all results need to be looked at with a critical eye.

When looking at the gender and unit differences under 4.2.2 and 4.2.1 it is important to keep in mind that they due to possible lack of independence, too small sample sizes, skewed distributions and large standard deviations, are not statistically significant and should therefore not be used in analysis and decision making before more data is made available. There may be a preconceived notion that females are better at hand hygiene than males. There were few studies found, that looked properly at gender differences in handwashing behaviour. However, one study from 2003 suggests that females respond better to visual prompts (H. D. Johnson, Sholcosky, Gabello, Ragni, & Ogonosky, 2003). Another study looking at gender and ethnic differences in hand hygiene practices among college students concluded that African-American students, compared with those of Caucasian origin, had significantly higher rates of hand hygiene practices, and females had generally higher rates than males (Anderson et al., 2008). The current intervention did not use visual prompts as part of the nudging, and hence inclusion of this may also have a positive effect, particularly on female soldiers. In a mixed population like in the Army, it may be that the effect on one group also has a positive influence on the other.

5.2 Limitations

The most important limitations in this study, apart from those on validity discussed below, relate to the *independence of observations*. The nature of this quasi-experimental design made it difficult to know whether to treat the measurements as a paired (pre- and post-intervention) sample, hence comparing the means using a *paired sample t-test*, or treating the test groups before and after the intervention as two independent groups, using *an independent samples t-test*. Most likely many of the same subjects were measured in both group samples. However, this cannot be known as the individuals were not identified. Furthermore, there was an imbalance in numbers between the test group measured pre-intervention (n=251) and the test group observed after the intervention (n=431). The nature of a military unit of this type (mechanised infantry) typically encourages uniformity and working together in a highly coordinated fashion. Because of this they are perhaps more likely to influence each other's performance e.g. when washing hands together. Initially, when using a stopwatch rather than recording start / stop times, busy queues of soldiers could lead to a measurement error when numbers were mixed up, etc., possibly leading to further shortfalls of independency.

It is also considered plausible that one person's handwashing behaviour may influence the ones standing next to them, particularly if there is a long queue of people waiting to wash hands, as the inclination of many soldiers would lean towards being as quick and efficient as possible. This could be either in order to alleviate the queue, or get quicker to the food. However, to circumvent this problem and to try and get more independent observations, the stacked sampling method used in the intervention meant that there was at least one minute between starting each new observation, thereby minimising the influence they had directly on each other.

Another problem of independence relates to the fact that none of the subjects were to be identified, and have therefore most likely been measured several times on different occasions. Due to the relatively large sample it is also likely that the same persons may have been measured in the pre- and the post-intervention groups. This should not be unique for this research project and does not surface as a concern in most of the papers found assessing hand hygiene behaviour, but did raise the question as to whether a paired sample t-test design would have been preferable. However, as long as that research would have required individual identification as well as more elaborate preparations to conduct, particularly without influencing the results through rumours or someone pre-warning the subjects, the chosen protocol was preferred. There would also be the risk of having subjects modifying their performance when knowing that they were being watched, a common problem named the Hawthorne effect (Adair, 1984; Srigley et al., 2014).

Examples of the Hawthorne effect were difficult to avoid on the conscript side of Setermoen Military Camp, where the baseline data was collected. This was due to the presence of duty officers checking that everyone washed their hands, routinely sending people back if they tried to go through without washing. As the same duty officers now could be observed with stopwatches, filling in forms, this must be taken into account when looking at the results in this group. The stable values throughout the group of lower ranks seen in Table 6, mean durations ranging from 8.37 – 9.44 seconds, may however, give an idea of what can be achieved when applying regulation to encourage handwashing, rather than nudging. In contrast to this group, the mean durations on the side of the officers were consistently longer (11.32 – 16.67), even if they in principle were free to do as they wished. One cannot discount that some officers may have been inadvertently informed about the project, hence becoming subject to their own Hawthorne effect.

5.2.1 Strengths and Weaknesses

One strength was the pragmatic aspect of this applied research, showing that a military setting can provide data for internal use as well as for publication. This contributes towards decisions based on facts rather than preconceived notions and guesswork. The data itself is also useful in providing feedback of performance and further ‘nudging’-efforts, establishing useful baseline values. When using the simple parameter of handwashing duration only, the described methodology can be applied repeatedly, becoming a useful management tool.

However, implementation of the current project was filled with obstacles, and due to conflicting activities only 180/480 (37,5 %) of the test unit members attended the intervention briefing. The ratio of Officers (OF) to Other Ranks (OR) were approx. 30/70 (Christian Næss, pers. com.). The military system is devised such that, as long as a subunit is represented by someone, they will bring information back to those who could not make it. However, the robustness of that system on this occasion is not known. It is also a concern that the unit commander and his closest staff had to excuse themselves as being prohibited from attending the nudge-briefing. Hence the important principle of *leadership buy-in* to such projects of behavioural change in organisations, could clearly have been better fulfilled. Unfortunately, preventive medicine is to a large extent seen as the business of (a small part of) the Medical Service. This does not have to be the case, as raised by UiT professor in Health Economics, Jan Abel Olsen: “*Why should prevention be a part of health care? As opposed to the provision of treatment and cure, it may be offered by others than health care personnel, not least one’s own efforts of behavioural changes* “ (Olsen, 2017). An important part of building resilience would be to have military commanders take a sincere interest in preventive medicine.

Another concern with the intervention in this quasi-experiment is *implementation fidelity*, or to which degree the intervention was delivered as intended, as well as identifying which elements in the intervention that were the ‘active ingredients’. Included in this is also *quality of delivery* as well as participant responsiveness (Pannick, Sevdalis, & Athanasiou, 2016). This causes a problem with experimental reproducibility, which is a key requirement in the scientific method. This aspect, together with a possibly weakened internal validity means that application of the results from this research must always be considered carefully.

5.2.2 Internal validity

Internal validity depends on the extent to which the change observed in the dependent variable (*Hand hygiene*) is caused **only** by the independent variable (*Nudging*): Two factors that may have influenced the hand wash duration include that of *history* and “regression to the mean”. However, since the pre and post-intervention sampling were done in time periods of approximately five days each, few coinciding events should have influenced this. Also comparing day by day means and deciding whether or not are similar, could be done to check for this. “Regression to the mean” is caused by time to time variation according to any human’s natural variation in performance. This should be minimised by relatively large sample sizes over several days, and even if not actively randomised, the systematic tendencies in the sampling were attempted kept to a minimum.

Two other threats to internal validity are the effects of *maturation* and *selection* and as random selection and control group assignment have not been practicable, this is clearly a possible explanation to the effects seen other than the nudging intervention. The sampling took place over 4 months from February to May, 2019. There may have been other events that caused the changes observed, other sources of inspiration to increase focus on hand hygiene, such as the Global Handwashing Day (TGPPPH, 2019), which is held on October the 15th every year. There could also have been disease outbreaks or an approaching flu season that brought attention to the subjects, increasing their hand hygiene performance for that reason.

5.2.3 External Validity

Due to what has been termed the “healthy soldier effect”, data from military servicemen and women should not be extrapolated for application in the wider society. This is due to findings that death rates among military personnel, except in combat, often are lower than the death rates in the population in general (Waller & McGuire, 2011). This effect has been well documented in the Norwegian Navy, in spite of the fact that Norway has national service and attempts in its recruitment to mirror society at large (Strand, Martinsen, Koefoed, Sommerfelt-Pettersen, & Grimsrud, 2011). The safest would be to consider applying the results to other military communities only. Similar professional units to TMBN could be comparable, but since both selection and training may differ, care should be taken. Due to the social standing of military service in Norway, recruitment into the Armed Forces may encourage personnel with higher aptitude and education than in certain other countries and therefore the external validity is limited.

5.3 Nudging versus Regulation

In the last decade, many private as well as public institutions have shown an increasing interest in the use of nudges. This is because they are relatively inexpensive and have a potential to stimulate a variety of goals. The establishment of UK's *Behavioural Insights Team*, and USA's *White House Social and Behavioural Sciences Team* offer examples of this recent development. One of the "founding fathers" of nudging, Harvard Law School professor Cass Sunstein argues that *"It is true that some nudges are properly described as a form of "soft liberal paternalism" because they steer people in a certain direction. But even when this is so, nudges are specifically designed to preserve full freedom of choice. A GPS steers people in a certain direction, but people are at liberty to select their own route instead."* (Sunstein, 2014). Such liberty as described above is granted military commanders in particular, as they by necessity are trained and expected to operate largely autonomously. Some may also use this mandate when in need to prioritise their focus and concentrate their span of attention in response to a seemingly endless number of new rules and regulations. This may come to affect compliance with all those regulations not directly concerning the warfighting. As such, nudging may still provide a way forward as a tool for the medical service, in order to increase military compliance to public health regulations and advice. Extensive research on what works, for whom, and under which circumstances may still be needed. However, comparing the effects of different types of nudges in different regulatory environments has been done, suggesting nudging may itself help to promote a culture that is accepting of legislation (Roland et al., 2011). Decision-making is based on what is the current situational picture held by the commander, and rather than making efforts to collect data in a series of randomised, controlled trials (RCT), time will generally at best allow to call for an expert opinion on the matter, a so called subject matter expert (SME). Staff from the medical service should hence perhaps position themselves to use this opportunity to nudge, describing relevant health risks, advising on mitigation, and assessing consequences. This could also be done in the role of intelligence analyst, or as a medical planner in the operational planning process (OPP). In the current information environment, having academics that also interact well within a busy military staff could be potentially very valuable to the outcome of the decision making process. Medical Intelligence and Information (MI2) is a new discipline that is under development both within NATO's command structure and among member- as well as partnership nations (Bedubourg, Wiik, Queyriaux, Lausund, & Meynard, 2018). However, it

seems to be poorly integrated into military- planning and intelligence staffs, and there is much room for improved collaboration. This multidisciplinary field may also help fill an important void in the decision making tool box of national public health (PH) organisations (Wiik et al., 2017). Perhaps also more military commanders should take deeper interest in preventive medicine as well, integrating it fully into their Force Protection efforts, and asking more often to be *shown the data* before accepting any incoming information at face value.

5.4 Soap and water vs hand sanitiser

In 2005 there was a campaign launched by the Norwegian Public Health authority encouraging the use of hand sanitisers rather than soap and water (Dyvi, 2005; FHI, 2005). The arguments were based on the recurring poor compliance of traditional handwashing as well as the superior time and cost efficiency of hand sanitisers. The biocidal effect of alcohol-based hand sanitisers was, according to trials on a selected test-bacterium *E. coli* K12 (NCTC 10538), twice as efficient as soap and water, requiring a duration of 15 rather than 30 seconds. While soap and hand sanitiser products were similarly priced, there would be no need for hot water supply, paper towels and the associated waste handling. In addition, the hand sanitisers were supposedly gentler on the skin for the many health care workers (85%) who had experienced “skin problems” caused by frequent exposure to soap and water. Scrutinising these data for bias due to hidden agendas or simply poor science, may have been worthwhile.

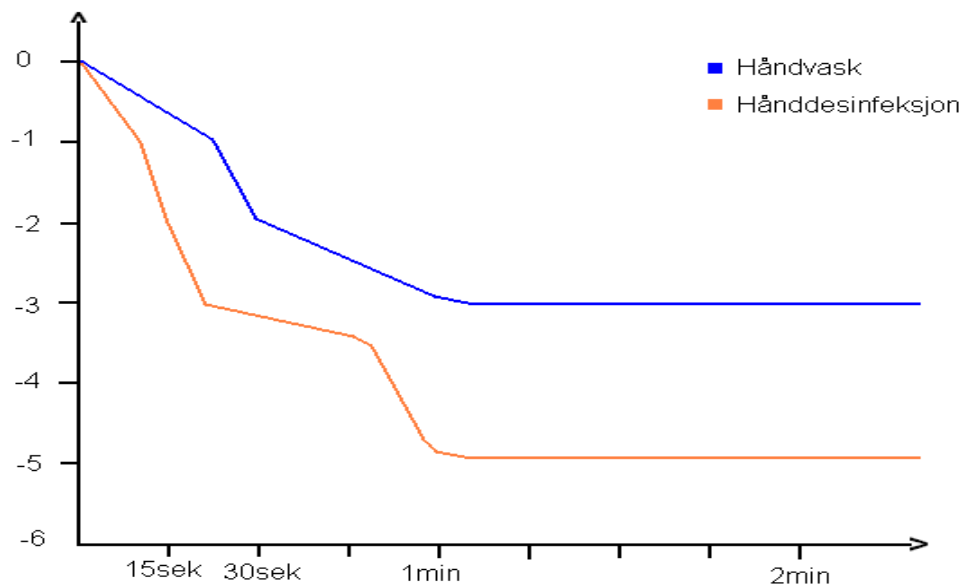


Fig. 1: Curve comparing the effects of microbial reduction over time, between soap and water (blue) and alcohol based hand rubs (amber). Results assuming no visible dirt. National guidelines for Hand Hygiene (FHI, 2005).

In the revised Norwegian guidelines, published on the web in 2016, the claimed benefits of using hand sanitisers are much more nuanced, listing a number of limitations, such as a tendency of health care workers to apply insufficient amounts of alcohol-based foams, reportedly because they wish to avoid the prolonged drying time (Kampf et al., 2010). More important is perhaps the concern about the active ingredient ethanol's lack of efficacy against naked viruses such as *Noro-* and *Rotavirus*, spore-forming bacteria such as *C. difficile*, the skin parasite *scabies* and most lately also the *influenza virus* (Hirose et al., 2019). This seems particularly true when inadequate amounts are applied, or the viral containing mucus is fresh and not dried, such as when previous efficacy tests were conducted. In other studies, combined Non-Pharmaceutical Interventions (NPI) such as use of hand sanitisers and training in hand and respiratory hygiene, appeared in one study to have a significant effect, reducing absence episodes with 25 % among school children in Pennsylvania, and reasons unexplained they also seemed more efficacious against Influenza A than Influenza B (Stebbins et al., 2011).

5.5 Duration as a parameter

The use of handwashing duration as the main parameter for measuring hand hygiene has important weaknesses as it is based on some important assumptions. One is that the subjects do not stand on handwashing station without actually washing hands. This could be the case if

the water in the faucet is simply too hot, or too cold. The exact reasoning behind minimum time as a measure of handwashing adequacy in official recommendations is not always clearly stated, but it is assumed to be related to the minimum time required to be able to cover all skin surfaces of the hands adequately. Moreover, the microbicidal effect would normally have a time component, as well as a dosage component. In the current study, time taking was started as the automatic faucet opened its flow, and a subject who

in accordance with the nudge-briefing starts with water before applying soap, will therefore score better than those who apply the soap first. The water flow stops automatically after approximately one second if the hands are removed, e.g. for soap application or hand rubbing without rinsing, and then starts again when hands are to be rubbed under water or need rinsing off. The handwashing duration parameter is based on the assumption that the entire set of actions after water has been applied for the first time will contribute to hand hygiene and have an accumulative positive effect on the decontamination process. It was not possible to assess the actual handwashing techniques with this method. However, a specified technique was taught during the nudge-intervention, which if correctly performed, would take no less than 10-15 seconds, then allowing for further repetitions. It is also assumed that the problem of persons occupying a position at the hand wash basin without actually washing hands is negligible as there is a high likelihood that such behaviour would be regarded as unacceptable by the others waiting in line, and is not particularly soldier-like. The method is therefore particularly suited for soldiers.

According to Geoffrey Rose, the shape of the dose–effect curve is critical when planning for control policies (Rose et al., 2009). The importance of having such curves apply, in spite of the fact that we often do not have sufficient data to prove the exact shape of the curve. Hence, based on the plausible idea that in many circumstances dry contaminated hands do not become safer by briefly wetting them under the faucet, the additional term handwash failure was introduced, replacing the 0 second No-wash category. The cut–off was arbitrarily set to all values below 3 seconds based on this argument. The dose – effect curve below can be further modified but it is suggested that in future analyses, some sort of handwash failure threshold, taking adequacy more into account is established. The goal for adequate hand hygiene level may also be set to increase gradually, or fixed according to future research findings in this area. It is suggested that a mean handwashing duration goal of 15 seconds is set initially, hoping that a population approach will take more people out of the >3 sec-high risk zone.

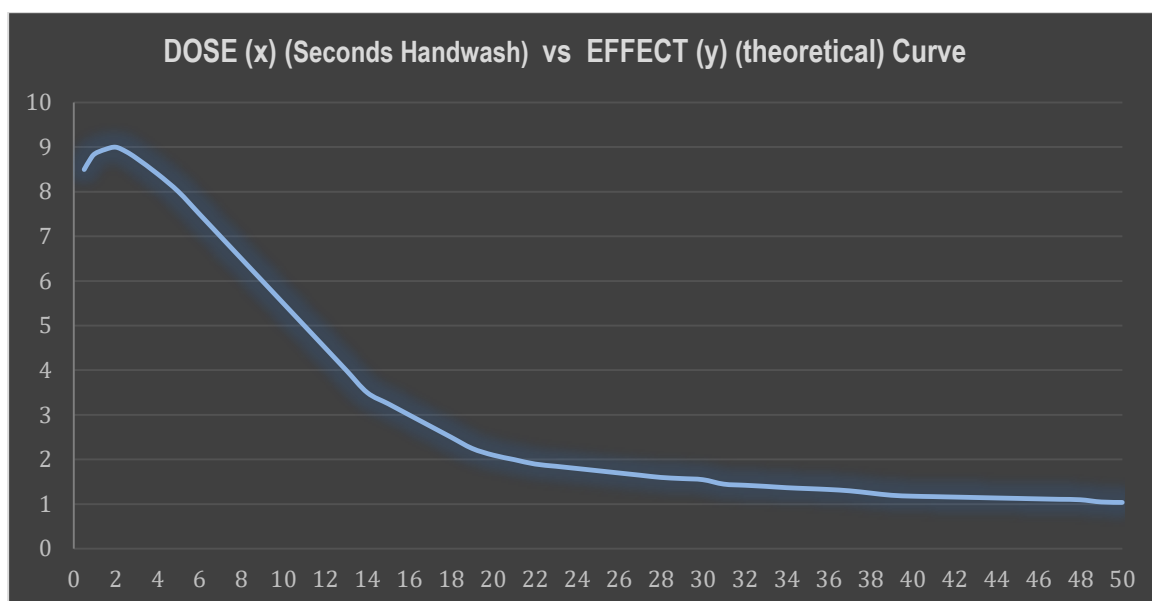


Figure 2: Suggested shape of dose - effect curve where less than 3 seconds of handwashing may increase risk as wet hands may deposit or pick up transient flora more efficiently than dry hands, hence a very short wetting of hands may be counterproductive.

This curve gives perhaps a more realistic picture of the effect of the intervention. New odds ratios were calculated for comparison, modifying the result obtained when using 0 sec, OR = 3.54 (33.42, 9.45), to an OR for washing hands for <3 sec. The results are still significant with the Chi Squared statistic being $\chi^2 (1) = 16.21, p < .001$. Based on the new odds ratio, the odds of people washing their hands was now 2.42 (11.91, 4.93) times higher if they were in the group that received nudging than if they were not. That is still considered a successful effect, while leaving more room for improvement. More nudging emphasis is therefore needed on the duration, pointing out the hazards of extremely short handwashing durations.

5.6 Long term effect

The perhaps most important limitation of this study is the lack of data on the longevity of the effect. It was known from experience that for the meal times immediately after a traditional hygiene brief was given, handwashing would be given more attention than normal. This was thought to be a short-lived effect as old habits are generally hard to change. Also, soldiers are not selected to exhibit high levels of anxiety, probably a good thing in warfighting but not great for preventive medicine programmes, as they may feel more invincible, thinking they

never can get sick. It may not be easy to convince them with facts either. The way Semmelweis' empirical observations were rejected in the past may be explained by a psychological tendency of clinging to discredited beliefs. A more recent research finding illustrating this is when corrective information which was adapted from the Centers for Disease Control and Prevention (CDC) website, significantly reduced belief in the myth that the flu vaccine can give you the flu as well as concerns about its safety. However, the correction also significantly *reduced* intent to vaccinate among those respondents with high levels of concern about vaccine side effects. This result, in line with previous research on misperceptions about the MMR vaccine, suggests that correcting myths about vaccines may not be an effective approach to promoting immunization (Nyhan & Reifler, 2015).

There was a period of home leave, given to the test unit (TMBN) immediately after the intervention brief, and this may have affected the results, either reinforcing, or making them forget more easily about the nudge. Also the introduction of a unified handwashing drill, may have left a longer lasting impression on the soldiers, and giving them this capability was considered a very important part of the nudge. A recent study where a simplified hand washing technique was compared with two different techniques with increasing complexity, indicated that a simple technique is more likely to maintain compliance. However, this was a mother/child study in Bangladesh (Amin et al., 2019), and it may therefore not extend validity applying to soldiers in Norway. Nevertheless, it is well established that even health professionals need regular reminders in order to maintain compliance to hand hygiene recommendations, so the one-week duration of a significant effect may be a useful starting point when devising further elements of nudging, perhaps spreading them out in time. Further research efforts might include repeat sampling 6 months post-intervention, then perhaps including a control group that did not receive the nudge as this should generate interesting additional information on longevity of the effect. However, the chance of other factors influencing the test- and control group may increase with longer time spans.

5.7 Operational significance

Intelligence products are used to inform decision makers about potential risks to mission and to personnel, and the current predictions of *invisible threats* will require civil military cooperation, specifically with cases involving chemical or biological agents. As these often are in fact invisible, we rely on strict decontamination procedures, including the correct use of

water, soap and disinfectants to protect ourselves. If such procedures were more engrained in everyday life, the affected population should be less vulnerable. Handwashing has over the last century emerged as one of the most important methods to mitigate the spread of infection. To respond adequately to biological and chemical events there is a notable collaborative effort in place between the Norwegian Armed Forces Medical Services (NAFMS) and the national CBRNE-centre, and in 2018 a civilian guidelines publication (Nakstad et al., 2017) was appropriated by NAFMS/FSAN, thereby made applicable also to the Norwegian military. NATO has also increased collaborative efforts with the European Union (EU) as well as many partnership nations, and in the same spirit Norway has been invited by the EU to head a new project on developing a common European medical contingency plan with particular focus on chemical and biological events (Guldvog, 2019). Important in both these cases would be the principle of zonal division, where there is marked separation between contaminated (**hot**), elevated risk (**warm**) and clean (**cold**) zones, with mandatory exit through a decontamination facility before entering the clean areas (Nakstad et al., 2017). Such “Hot zone management” must be swiftly implemented and strictly maintained in both civilian and military settings, should any chemical or biological events occur. Similar guidelines are issued also by NATO (Ragnar Boe (NATO Civil Emergency Planning Civil Protection Group), 2014) as well as Public Health – England, both guidelines of high relevance when it comes to civil-military collaboration (Gent N, & Milton R, 2018). Taking this principle a step further, using the clean, green zone as a concept in teaching soldiers about hygiene, this project suggests the following solution. Basic training teaches soldiers to think where green zones may be established, either in association with their own backpack, tent, vehicle, room or garrison. As with the dining facility, these safe areas should allow everyone to drop their guard, relax and concentrate on reconditioning. Mandatory decontamination using correct handwashing procedures will then become a useful guide and reminder to the soldiers as to when and why they need this skill as professional soldiers.

6 Conclusion and recommendations

This project has made a contribution towards increasing resilience in public health (PH) and the total defence framework by potentially making soldiers less vulnerable to the spread of infectious diseases. Baseline information was established and a test Unit (TMBN) was exposed to an intervention utilising the principles of nudging. Hand hygiene was significantly improved with handwashing durations increasing almost 33%.

Building public health resilience to invisible threats through better hand hygiene can clearly be achieved. However, military commanders need to take ownership of preventive medicine, which should include elements of nudging in addition to traditional regulation. The nudging should make a multifaceted approach, providing various prompts, repeated reminders and feedback of performance. The single parameter of handwashing duration developed in this study, can be further refined and established as useful tool within the Norwegian Armed Forces.

This applied quasi-experimental research has, in spite of several weaknesses, generated useful data to replace guessing and help modify preconceived notions and as such, helped improve decision-making in an increasingly fact-resistant environment. The following future recommendations are suggested:

- Establish the “Green Zone” as a well-known concept when teaching soldiers about hygiene. Always decontaminate (boots, coats, utensils, hands) before entering!
- As soldiers tend to perform manual tasks getting their hands dirty, soap and water is preferred over alcohol based hand rubs. Make the effort to provide warm-water access.
- Washing hands for less than 3 seconds is considered handwashing failure and a goal of mean handwashing durations in each unit should initially be set at minimum *15 seconds*, with emphasis on proper technique.
- Feedback of performance is required. Reporting quartiles of mean handwashing duration can be used when monitoring for improvement, as having just a few soldiers washing for very long durations, hence increasing the mean, is not very useful. Further studies establishing possible Unit variation should be undertaken in order to learn and provide motivation.

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Appendix

A. Data from Iraq coalition forces dining facility (DIFAC)

This appendix is a summary of data informally collected with permission from the NOR contingent commander in response to bold statements from NOR soldiers accusing colleagues from other nations of not washing their hands. Such accusations appear to be common in such settings, often reciprocally directed. Generally, there is no data of adequate sample size to substantiate the claims. The Norwegian units P, S, and T together made up a similar sample size to US (n = approx. 80), while the others were insignificant.

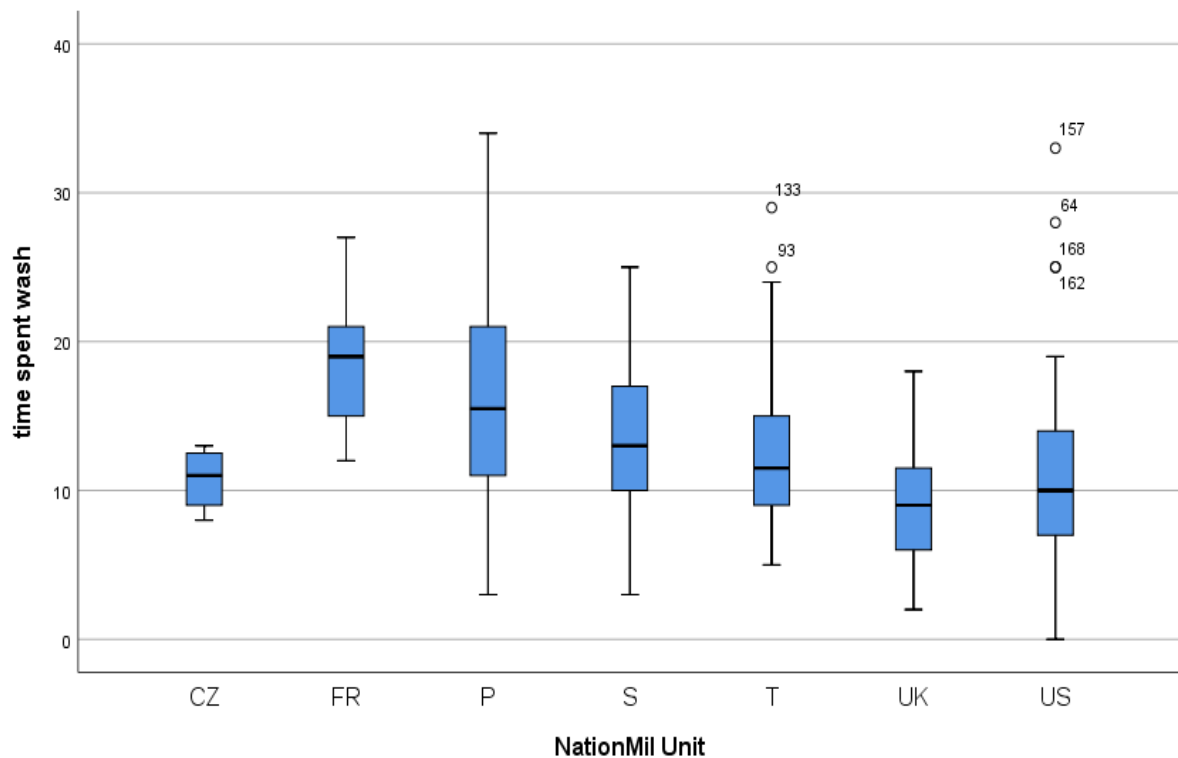


Fig. 2: Data showing handwashing duration in Iraq coalition DIFAC, indicating means, 50% of the sample (box) and max - min. The outliers could all be included and one 0 second reading was removed as (s)he did not eat.

By merging NOR data and including the ‘outliers’, none of which exceeded official Norwegian recommendations for handwashing duration at the time (up to 60 seconds), two of the nations (NOR and US) were compared to look for difference in mean handwash durations.

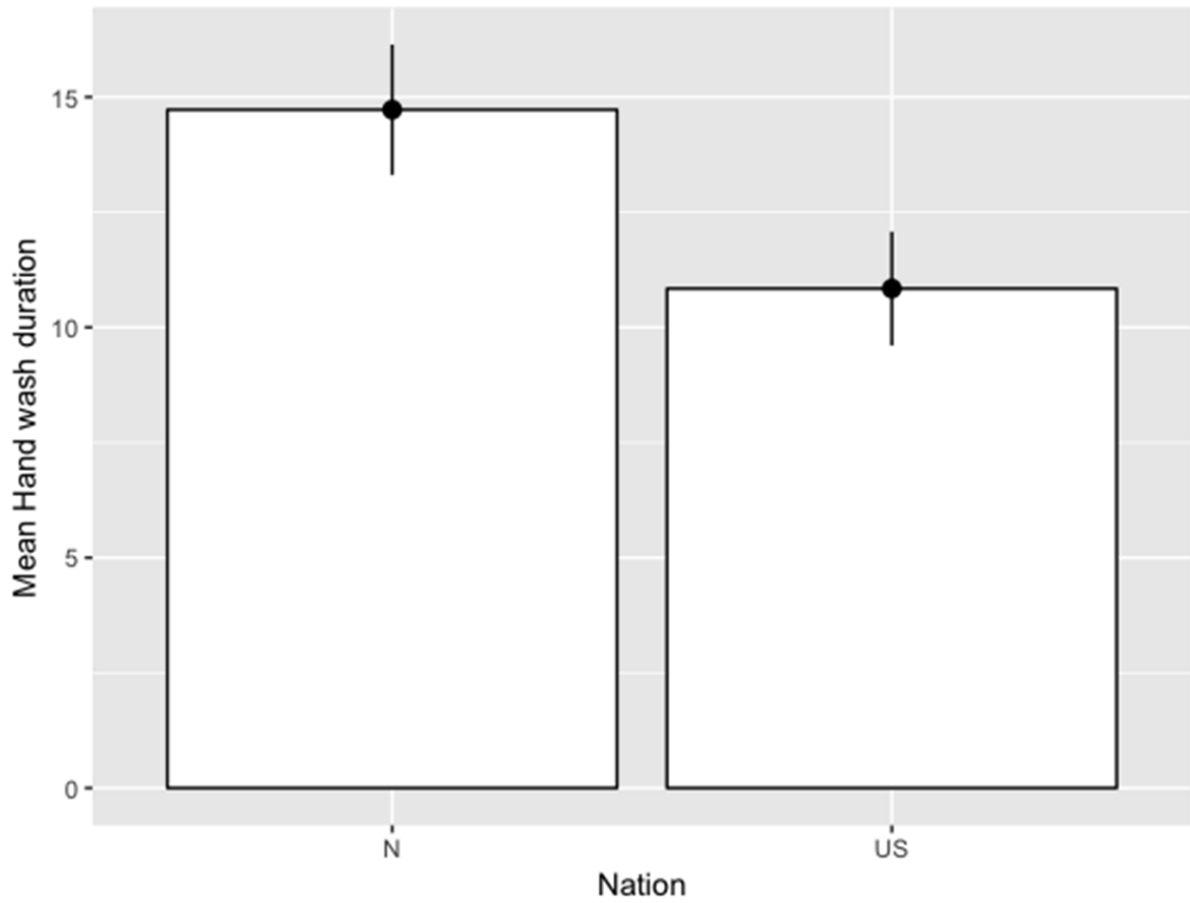


Fig. 3: Merged data indicating handwashing durations that significantly differ (95% CI-lines do not overlap) in favour of Norway. The claim of no hand washing was refuted.

B. Shigella outbreak in Masar e Sharif

Slide briefing provided with permission, courtesy of Lt. Col. Håkon Wessel Asak, NAFMS.

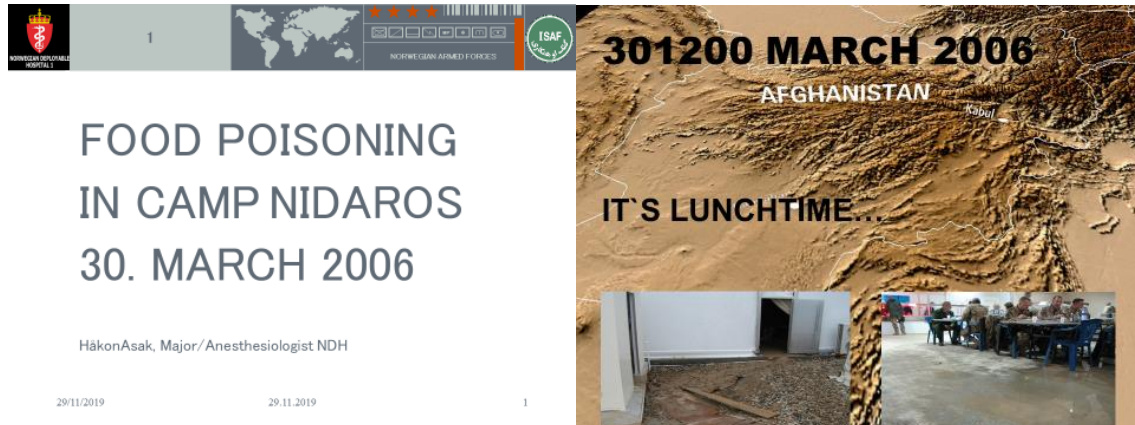


Fig. 4: Slide briefing describing findings by Medical and Veterinary Services in ISAF, Afghanistan in association with a large food poisoning outbreak in 2006.



Fig. 5: Inspection of the kitchen by the Veterinary Officer reveals poor routines for separating clean and unclean items. No suitable toilet or resting facilities available to kitchen staff.



Fig. 6: Locally employed unskilled labour, assisted by cook in unclean zone (Note the lack of wardrobe facilities). 12 O'clock next day patients start arriving.

FORSVARET
Hærens våpenskole
Sanitetskolen

MISTANKE OM SHIGELLA DYSENTRI

- FORVENTET INKUBASJONSTID 1-5 DAGER
- SVÆRT INFEKSIØS, 10-100 BAKTERIER ER NOK



29/11/2019 29/11/2019 20

FORSVARET
Hærens våpenskole
Sanitetskolen



- HØY FEBER 38-41 °C
- OPPKAST
- MAGEKRAMPER
- DIARÉ, I NOEN PASIENTER MED BLOD OG PUSS
- MUSKELSMERTER
- HODEPINE
- SYNKOPE
- SEPSIS
- MENINGISME

16

Fig. 7: *Shigella dysentery* suspected as it has a short incubation period and requires only a low dosage to infect. The list of symptoms match.

011030 APRIL 2006

4 FORLEGNINGSTELT TAST I
BRUK SOM ISOLAT, MEN DET
ER IKKE NOK...




29/11/2019 21 22

Fig. 8: Four normal accommodation tents used as isolation units now full. Need for more space dictates the conversion of maintenance rub hall to temporary isolation ward.

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29/11/2019 23

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Sanitetskolen

RESULTAT BLODPRØVER



CRP 50-200
NEUTROPHILI > 90%
LEUCOCYTOSE
STYRKER MISTANKEN OM
BAKTERIELL INFEKSJON

VAKTHAVENDE KIRURG PÅ NDH

24

Fig. 9: Growing number of G-I patients submitted, including "Surgeon on Call" from Norwegian Deployable Hospital (NDH). Bloodwork strengthens suspicion of bacterial infection.



Fig. 10: Support from allied DEU military health care workers arrived. Also CBRN sanitising support was requested in order to clean up.



Fig. 11: Overview showing number of patients treated, recovered and still hospitalised. Shigella sonnei Lab-confirmed. List of possible complications and sequellae is long.

This briefing from Afghanistan 2006 clearly demonstrates the operational vulnerability of kitchens providing food for soldiers.

C. Nudging Intervention Brief content (45 min)

Hærens nye Hygienekonsept

- Sjefsveterinærens intensjon (under utvikling)
- Hvorfor TMBN?
- Ekstra kompetanse (evidensbasert)
- «Fi» = Bakterier og virus (mest fra avføring)
- Håndvaskedrill
- Videosnutt / Hygienefolder
- Noble Jump

Sjefsveterinærens intensjon

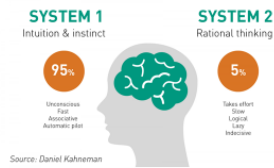
- Hensikten er at Hæren skal bli mindre sårbar mot smitte og sykdom.
- Vi vil oppnå dette ved å skille mellom **rent** og **skittent** område (på alle felt), gå alltid fra rent mot skittent, og alltid dekontaminere **FØR** man går tilbake på rent.
- Slutttilstand er nådd eventuelle tilfeller av smittsom sykdom **IKKE** får noen avgjørende innvirkning på Hærens oppdragsløsning

MES 2006 QRF

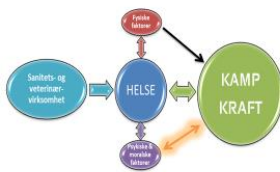


Drill – System 1 – System 2

- En ball og en racket koster tilsammen kr. 110,-
Racketen koster 100,- kroner mer enn ballen.
Hvor mye koster ballen?



Helse påvirker Hærens kampkraft



Fra Stabsbåndbok for Hærens Sanitet (2018)
Tilpasset med tillatelse fra Jan Abel Olsen, UIT.

HYGIENEKONSEPT I HÆREN

FELT: ET FLEKSIBELT KONSEPT FOR DEN MODERNE HÆREN

HYGIENE = VEDLIKEHOLD AV SUNNHET

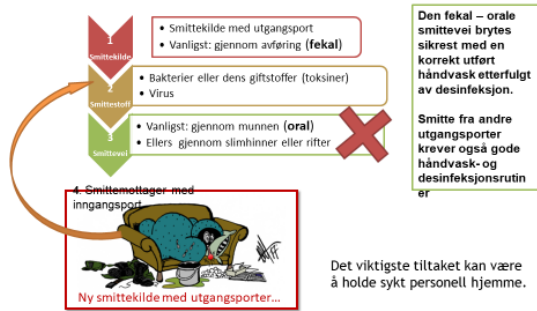


Tenk hygiene i ALT du gjør...

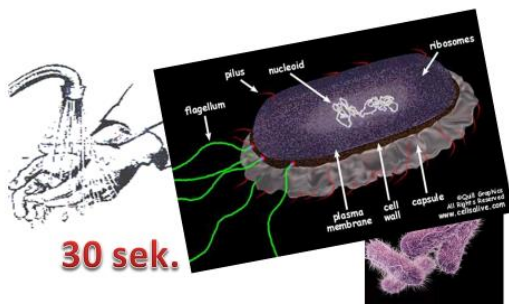
TMBN er kanskje Hærens mest profesjonelle avdeling



Hvordan bryte pågående smitte ?



Fastboende og «fremmedkrigere»



REN → UREN

- Hold orden og tenk hygiene i alt du gjør:
- Skill mellom **ren** | og | **uren** sone
- Gå alltid fra rent mot skittent. Når du skal gå tilbake til rent må du alltid først

DEKONTAMINERE

Dvs. **vask** først (helst m. såpe og vann), så kan du **desinfisere** med håndsprit om nødvendig (Er hendene synlig rene, kan det holde med sprit)

Hærens håndvaskeprosedyre (1)

- Grunnleggende ferdighet for all hygiene:
- Totrinns håndvaskedrill med 3 eller 5 repetisjoner. De er identiske men den på 5 reps er grundigere (tilpasset pågående utbrudd). Start alltid med å skylle hendene godt for å fukte huden. Den samme teknikken brukes ved spriting av hender, både i garnison og i felt, men da må hendene være så **rene** og **tørre** som mulig for å oppnå tilstrekkelig effekt.

For å endre bunntekst og dato, velg «Vist» - «Toppunkt og bunntekst»

2019.11.16

Hærens håndvaskeprosedyre (2)

- Etter påføring av en generøs slump med såpe / desinfeksjonsmiddel i venstre hånd gnis håndflatene mot hverandre: (3 X)



- så legges først Høyre over venstre håndbak(3 X), og så gni middelet godt inn mellom fingrene.



For å endre bunntekst og dato, velg «Vist» - «Toppunkt og bunntekst»

2019.11.16

Hærens håndvaskeprosedyre (3)

- .. og deretter venstre over høyre (3 X) slik at også denne flaten blir rengjort.



- Ved siste gang griper man over fingrene og gnir begge knokene godt 3X.



For å endre bunn-tekst og dato, velg «Vis» - «Toppunkt og bunn-tekst»

2019.11.16

Hærens håndvaskeprosedyre (4)

- Neste glidende overgang blir å gripe rundt høyre tommel (3X) og så venstre tommel (3x).



For å endre bunn-tekst og dato, velg «Vis» - «Toppunkt og bunn-tekst»

2019.11.16

Hærens håndvaskeprosedyre (5)

- Avslutningsvis skyves fingertuppene mot gropen i håndflatene på begge hender slik at restspriten trenger inn under neglene.



- Da er det ofte lite sprit / såpe igjen (fyll på), og det er svært viktig at alle neglene er kortklippte og velstelte, uten synlig «sørgender». **Befalet skal inspisere negler jevnlig, da dette sikrer at alle har riktig fokus på håndhygiene.**

For å endre bunn-tekst og dato, velg «Vis» - «Toppunkt og bunn-tekst»

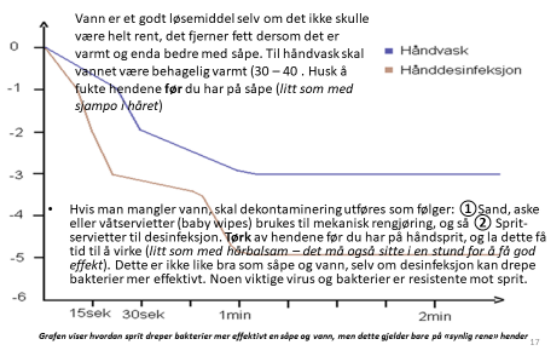
2019.11.16

Makkersjekk / Sibir

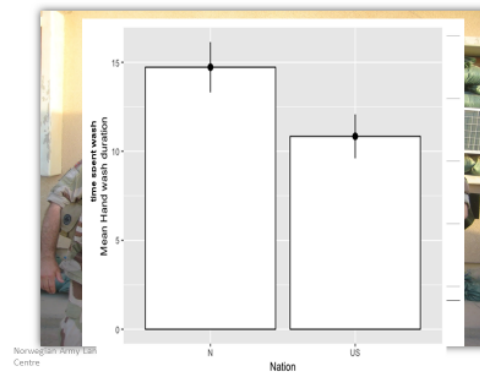
- Husk **Ren** → **Skitten** (begynn med ansiktet)



Info om såpe og vann vs. sprit



Show me your data !...



Ikke utgjør en økt RISIKO...

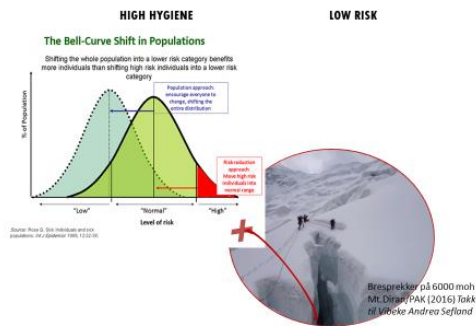


Fig. 12: The exact PowerPoint slides used in the nudging brief. In addition, a short video, promoting the new hand wash drill was shown (approx. 3 min). Contact information of author is Lt. Col. Harald Wiik, Norwegian Army Land Warfare Centre, email: hwik@mil.no or serengetivet@gmail.com