**An evaluation of the available evidence on hand hygiene for outdoor nurseries across Scotland**

<table>
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<th><strong>Situation</strong></th>
<th>HPS has been requested by the Care Commission to provide the evidence base in relation to hand hygiene in the outdoor nursery setting in order that they may use this information to inform their regulatory process.</th>
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<tr>
<td><strong>Background</strong></td>
<td>The Care Commission regulate outdoor nursery services in Scotland, one of which has no support building i.e. the provision of proper toileting and hand washing facilities. The service operates five days a week as an all day service. This takes place outdoors throughout the year. The children using this service are cared for in a community-wooded area in the countryside. At a recent Care Commission inspection concern was raised at the lack of hand washing, particularly after toileting and before handling food. The service provider is ardently proposing that they continue to utilise hand wipes and sanitisers for cleaning children and staff hands when visibly soiled, following “outdoor” toileting and before eating.</td>
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| **Assessment** | 1. **Introduction**  
Hand hygiene is widely acknowledged and accepted internationally as being crucial in preventing and controlling the spread of infection. The phrase hand hygiene encompasses all aspects of hand cleansing, for example, using:  

- Soap (either liquid or solid) which may be either antibacterial/antimicrobial or a plain detergent, i.e. regular soap.  
- Hand rub / gel which may contain varying concentrations of alcohol (ethanol, isopropanol or n-propanol) or a combination of these (ABHR).  
- Hand wipes pre-wetted with an antiseptic used for wiping hands to inactivate |
and/or remove microbial contamination.

- Non-alcohol based hand sanitiser (including benzalkonium chloride or polyhexamethylene guanidine-based products) (non-ABHR).

ABHR is the recommended product for hand hygiene in the healthcare setting provided hands are not soiled or visibly dirty.\(^1\),\(^2\) The use of antimicrobial impregnated wipes has been considered for hand hygiene in healthcare settings however, it has been shown that such wipes are not as effective as hand washing or the use of ABHR. There is limited evidence related to the efficacy and tolerability of non-ABHR and the use of these products within healthcare settings is not supported by robust epidemiological studies.\(^3\),\(^4\)

To date the focus of much of the published research has been on hand hygiene in the healthcare setting, examining aspects such as: when to perform hand hygiene; how to perform hand hygiene; how frequently hand hygiene should be performed and what products should be used.

The initial focus on hand hygiene in the healthcare setting has been enhanced following further research which examines the role of hand hygiene in non-healthcare settings such as patients’ homes, schools and other institutions, and in the food/catering industry. It was unclear as to whether or not any evidence had been published which directly related to the pre-school environment, including outdoor nurseries. Therefore a systematic search of the extant professional literature, focusing on hand hygiene in the pre-school environment, was undertaken and international guidelines on hand hygiene and relevant investigative reports were reviewed. Specifically, this review of the evidence sought to determine:

- Any legislative or mandatory requirements pertaining to hand hygiene and petting zoos/city farms/open access farms or outdoor nurseries.
- Known risks factors for petting zoos/city farms/open access farms or outdoor nurseries.
- If ABHR should be used in the non-clinical childcare setting.
- Any known risk factors relating to ABHR use and children.
- The efficacy of hand wipes/ABHR/non-ABHR compared to hand-washing with soap and water.
- Non-clinically based indications for hand hygiene.

### 2. Review of evidence
2.1 Legislative or mandatory requirements pertaining to hand hygiene and petting zoos / city farms / open access farms or outdoor nurseries:

There is no direct legislative requirement relating to petting zoos / city farms / open access farms or outdoor nurseries relating to hand hygiene; however the Health and Safety at Work Act (1974)\(^5\) and Control of Substances Hazardous to Health (2002 as amended) regulations\(^6\) legislate that employers must provide their employees adequate protection against the risks associated with the task being undertaken. Employees have a responsibility to comply by ensuring that suitable precautions are in place in relation to the task being carried out. All of the UK legislation and regulations outline the responsibilities of the employer and employee and also cover the unnecessary exposure to risk of service users.

The Health and Safety Executive (HSE) have also produced an Agricultural Information Sheet (ASI23)\(^7\) which outlines the importance of effective hand washing and the provision of hand washing facilities on open farms in order to prevent ill health. This information sheet also contains a section designed to inform teachers of the risks associated with open farms, as well as providing indications for hand washing, for both teachers and children, whilst on a school visit.

The HSE information sheet specifically highlights *E. coli* O157 which can cause severe illness and have serious health consequences for young children. Although some *E. coli* O157 infections are due to food poisoning, in Scotland, outbreaks have also occurred in various outdoor settings such as campsites and agricultural show grounds. Person-to-person spread can also occur. (The incidence rate of *E. coli* O157 infection for Scotland as whole was 4.6 cases per 100,000 population in 2009, this is higher than the reported rates for countries in mainland Europe).

Although cattle and sheep are the main reservoir of *E. coli* O157, it is not limited to farm premises, and has been found in many other species, including rabbits, deer and other wild animals, as well as horses, birds and slugs. Infected animals are rarely sick and cannot be identified without laboratory testing. Up to 10% of cattle in Scotland may carry the organism, which can survive for some months in soil and on grass, as well as in dung. It can spread through the environment in burns and rivers. It has been found in pet dogs, cats and horses, as well as on human footwear and children’s’ pushchairs. **No rural environment can be considered free of *E. coli* O157 contamination.**

Only small numbers of *E. coli* O157 organisms are required to cause human
illness, and will not be visible as dirt. Compared to many other organisms, \textit{E. coli} O157 only developed the capacity to cause human illness relatively recently. Exposure to \textit{E. coli} O157 was less common in previous generations, and spending time in the countryside does not guarantee protection against illness. Children living on farms and in rural areas, despite having routine exposure to livestock, have developed serious illness or died, after becoming ill due to \textit{E. coli} O157 infection.

As a result of past outbreaks in outdoor settings in Scotland, there is a wealth of guidance on \textit{E. coli} O157, outdoor risks, and how these may be reduced. The links below are not exhaustive, as the range of potential outdoor hazards is extremely wide.

\textbf{\textit{E. coli} O157 - HPS Guidance and Information:}


\textbf{\textit{E. coli} O157 - Other agencies' guidance and information:}

- [http://www.scotland.gov.uk/Publications/2003/06/17334/22401](http://www.scotland.gov.uk/Publications/2003/06/17334/22401)
- [http://www.hse.gov.uk/agriculture/articles/health-alert-ecoli.htm](http://www.hse.gov.uk/agriculture/articles/health-alert-ecoli.htm)

\textbf{Preventing person-to-person spread (various organisms):}


\textbf{Various diseases related to animals and outdoor settings, and other relevant agencies:}

- [http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5805a1.htm](http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5805a1.htm) (Various species and pathogens)
- [http://www.hse.gov.uk/campaigns/farmsafe/ecoli.htm](http://www.hse.gov.uk/campaigns/farmsafe/ecoli.htm) (Rabbits and other hazards - HSE)
- [http://www.scotland.gov.uk/Topics/farmingrural](http://www.scotland.gov.uk/Topics/farmingrural) (Scottish Government)

\textbf{2.2 Risk factors for children associated with petting zoos / city farms / open access farms or outdoor nurseries:}

The risks associated with children attending petting zoos / city farms and /or open
access farms have been well documented as outlined above. The Centers for Disease Control and Prevention (CDC) have published guidance intended to reduce the risk associated with animal contact in public settings. This guideline identifies enteric bacteria or parasites as posing the greatest risks to human health and children <5 years of age as being a population group which is at particular risk of serious infection. Furthermore, the guidance states that direct animal contact is not the only means by which individuals can contract an infection. Based on an analyses of recorded outbreaks, linked to petting zoos and other animal contacts in public settings, the CDC suggest that contamination of the environment, for example, an animal’s enclosure or the soil, can also be a source of infection. Additionally, the guideline highlights that it is not only domesticated animals, i.e. household or farm animals, which can pose a risk of infection but that pathogens can also be carried by wild animals. The guidance states that the primary route of transmission for enteric pathogens is via the faecal-oral route and that hand carriage is frequently associated with infection. Thus hand washing is cited as being paramount to decreasing the risk of infection linked to animal contact in public settings.

The Griffin report on the recent 2009 outbreak of *E. coli* O157 in visitors to Godstone Farm in Surrey highlights risk factors and makes several recommendations regarding access to open farms including the necessity for hand washing facilities and not relying on ABHRs / non-ABHRs. Children <5 years of age are identified as being a population group at increased risk of *E. coli* O157. Environmental contamination is also highlighted by the report as being a risk factor for contracting an infection without direct animal contact. The report states that the principal control measure for preventing *E. coli* O157 infection should be a focus on preventing visitor contact with animal faeces or faecal matter and that hand washing facilities are made available to the public after leaving an animal contact area, before eating or drinking and after removing footwear. Furthermore, the report states that sanitising hand gels (i.e. ABHR and non-ABHR) are not a substitute for thorough hand washing, but can be used as an adjunct to it. The report notes that several confirmed *E. coli* O157 positive cases reported that they had used ABHR and not hand washing.

The report by the Scottish Task Force on *E. coli* O157 identifies similar risk factors relating to children and *E. coli* O157 and that risk is not limited to farm premises. It also highlights that; research has shown that cattle herds, sheep, goats and other wildlife carry and excrete *E. coli* O157; surface water run-off from fields containing animal / bird droppings can lead to contamination of burns, streams and rivers during wet conditions; other organisms, such as *Salmonella* and *Campylobacter* are also
present in animal faeces / faecal matter; and during wet conditions contamination with
\textit{E. coli} O157 can spread more easily on hands, footwear etc. which in turn means that
there is an elevated risk that the organisms can pass into the mouth or contaminate
food and water. \textbf{In order to mitigate against these risks, the report suggests that:}
\textit{personal hygiene i.e. hand hygiene should be promoted generally; the
importance of hand washing should be publicised; and that the use of hygiene
facilities should be promoted within high risk groups, including nurseries or
playgroups visiting open farms or camping on agricultural ground.}

Three studies were identified which examine practices at petting zoos\textsuperscript{11},
enteric outbreaks in child care centers\textsuperscript{12}, and an outbreak of \textit{E. coli} O157.\textsuperscript{13} The
observational study on practices at petting zoos and zoonotic disease transmission
suggests that animals can shed a variety of pathogens, without displaying any clinical
abnormalities. Consequently, the authors recommended that contact with animals is
limited in areas where food is consumed, that hand washing facilities are provided
and that hand-to-mouth activities are restricted in animal contact areas.\textsuperscript{11} The non-
systematic review of enteric outbreaks in non-clinical childcare settings identifies \textit{E. coli}
O157 as being the most common pathogen responsible for outbreaks in this
setting. Furthermore, this study suggests that enteric outbreaks are exacerbated in
this setting because children are likely to be in close contact with each other, are
likely to put toys and equipment in their mouths and are less likely to wash their
hands properly after using the toilet. \textbf{Therefore, it is recommended that good hand
hygiene practice is performed in this particular setting; especially that hands
are washed with soap and water.}\textsuperscript{12} In the outbreak report on \textit{E. coli} O157 at a scout
camp, the route of transmission was determined to be via hand carriage caused by
environmental contamination. The authors recommended that hands are washed
before eating, drinking, smoking and that children under the age of five should be
adequately supervised.\textsuperscript{13} It is not possible to estimate a SIGN grade of
recommendation based on the evidence identified, however this evidence does
constitute recommendations made by national and international expert agencies and
professionals (Refer to Appendix 1 for further detail on levels of evidence). No
evidence or studies were indentified for this document which specifically examined
the outdoor nursery setting.

2.3 \textbf{ABHR use in the non-clinical childcare setting:}

There is good, high quality, available evidence to support the use of ABHR in a
variety of childcare settings, including day care centres (i.e. nurseries or
kindergartens), primary and secondary schools.\textsuperscript{14-22} Seven of the studies identified
and reviewed were randomised controlled trials (RCTs)\textsuperscript{15-19;22}, one was a
systematic review and the other a non-systematic review. The majority of the RCTs set out to test the hypothesis that the introduction of ABHR, used at specific times throughout the school day, and as an adjunct to hand washing with soap and water, would reduce overall absenteeism rates. Most studies included a control arm consisting of the use of soap and water and an intervention arm consisting of the use of soap and water as well as ABHR, some studies also tested the impact of an enhanced hand hygiene educational component.

Despite the inherent limitations of these studies (e.g. the use of cluster randomisation; difficulties associated with blinding (it is not possible to blind participants when the intervention is highly visible and obvious, such as the introduction of AHBR dispensers in the childcare setting); possible response bias (there may have been substantial differences between those individuals that participated in the intervention as well as those that did not); reporting bias (parents decided whether or not a child was well enough to attend school and this may vary between individual families); observer bias and/or variation (the RCTs relied to some extent on school records and absence recording by school staff); as well as the possible impact of the Hawthorne effect) these studies generally report an overall reduction in rates of absenteeism when ABHR is used as an adjunct to hand washing with soap and water. No identified study reported an adverse outcome i.e. that the introduction of ABHR with soap and water actually contributed to an increase in rates of absence. This reduction in absenteeism relates directly to a decrease in morbidity rates for Upper Respiratory Tract Infections and Gastrointestinal Infections among study participants using ABHR. Using SIGN methodology it is possible to estimate that the introduction of ABHR, as an adjunct to hand washing with soap and water, would achieve at least a level B grade of recommendation.

2.4 Risk factors relating to ABHR and children:

The risk factors associated with ABHR and patients (including children) have been well documented since the introduction of ABHR into the healthcare setting. Specifically, these risks relate to the effective and safe positioning of ABHR dispensers in order to minimise the likelihood of ingestion, fire or other unintended use. Similar consideration would have to be given to the positioning of ABHR dispensers in the non-clinical child care setting.

A limited number of papers were identified, which examined the risk of ABHR and children. One of the RCTs, which examined the use of ABHR in the non-clinical childcare setting, makes limited mention of risk factors for children. It suggests that the principal risk is for irritation of children’s eyes, which the authors suggest is
common to all washing products, and further states that children with underlying
eczema or other chronic skin conditions should not use ABHR. Another non-
randomised trial examining the use of alcohol free hand rub (non-ABHR) states that
the main risks associated with ABHR are that it is flammable, therefore a fire hazard,
and that it can potentially dry and irritate the skin. Another single cohort/case series
examined the database of the Texas Poison Network with the intention of identifying
any instances of unintentional exposure to ABHR by children under 6 years old. The
study concludes that the overwhelming majority of exposures recorded were mild and
self limiting with minimal toxicity. Similarly, another single cohort/case series
examined the safety of ABHR use in a child day care centre. In this study 82 children
had their blood alcohol level tested using a police breathalyser 15 minutes and 60
minutes after applying ABHR. Despite observations of children making frequent
contact with their mucosa, no child exhibited a blood alcohol level which was greater
than 0.01. No other studies which examine risk factors associated with the use
of ABHR by children were identified. It is not possible to estimate a grade of
recommendation based on risk factors associated with ABHR and children as
insufficient evidence was identified; therefore best practice (Good Practice Point) is
determined by expert opinion.

2.5 The efficacy of hand wipes / ABHR / non-ABHR compared to hand-washing
with soap and water:
There is unanimous consensus in the international guidance on hand hygiene,
as well as in the literature, that hands that are visibly soiled should be washed
with soap and water and that ABHR / non-ABHR should not be used as it is
ineffective against physical soiling. A high quality systematic review, a
meta-analyses / systematic review which assessed the effectiveness of hand
washing for preventing diarrhoea and a large scale RCT which examined the impact
of hand washing on child health were identified. The high quality systematic review
states that interventions designed to encourage and promote hand washing, with
soap and water, are effective in reducing diarrhoeal episodes by approximately
33%. Similarly, the meta-analyses states that the principal barrier for preventing
enteric pathogens is effective hand washing and the safe disposal of stools (faeces).
It acknowledges that while further research (specifically high quality randomised
trials) is required for hand washing, the available evidence suggests that hand
washing with soap and water is associated with a 47% (95% CI 24-63%) decrease in
the risk of diarrhoea; furthermore it suggests that hand washing was also associated
with a 48-59% reduction of risk for more severe enteric outcomes. The RCT states
that hand washing with soap and water has been shown to be efficacious in a number
of countries and settings in reducing Gastrointestinal and Upper Respiratory Tract
Infections. The study concludes that hand washing with soap and water resulted in a 50% reduction in Gastrointestinal and Upper Respiratory Tract Infections and that the use of antibacterial soap was not associated with any increased benefit: in fact the study suggests that the mechanical action involved in washing hands is more significant and important than the addition of antibacterials. whilst there are limitations inherent in these studies (for example, there are problems in generalising based on age due to the varied ages of participants across different studies, there are problems in blinding participants and study personnel, and reporting bias) they are consistent in their recommendation that hand washing with soap and water is effective in reducing both Gastrointestinal and Upper Respiratory Tract Infections. Using SIGN methodology it is possible to estimate that this intervention would achieve at least a level B grade of recommendation.

Two papers that examine commercially available antibacterial products were identified for the purposes of this document. A laboratory/experimental study examined the effectiveness of using an antibacterial soap for hand washing after changing nappies. The authors conclude that whilst there is a need for further research, that antibacterial soaps may be slightly more effective in reducing contamination on hands after changing a nappy. A robust high quality RCT, which examines the effectiveness of antibacterial cleaning and hand washing products, concludes that antibacterial products are not effective in reducing rates of Gastrointestinal and Upper Respiratory Tract Infections in a population of healthy individuals, including those <5 years old, irrespective of whether they are enrolled in day care or not. Based on the identified evidence it is not possible to estimate the grade of recommendation and further high quality research is required. No evidence or studies were indentified for this document which specifically examined the outdoor nursery setting or that examined the use of hand wipes.

2.6 Non-clinically based indications for hand hygiene:
Based on the evidence identified for this document, the non-clinical indications for hand hygiene i.e. hand washing can be summarised thus:

- After using the toilet. 
- Before and after eating, drinking or preparing food. 
- After sneezing, nose blowing or coughing. 
- If hands are soiled/dirty. 
- After leaving animal contact areas. 
- After removing footwear. 
- After outside activities.
- After changing a nappy.\textsuperscript{12}
- After entering and leaving a classroom - including first thing in the morning and before going home.\textsuperscript{12;16;19;20;26}
- After touching nose, eyes or mouth.\textsuperscript{12;19}

Using SIGN methodology it is possible to estimate that this intervention would achieve at least a level B grade of recommendation.

**Recommendation**

Although there is no direct legislative requirements for hand hygiene in petting zoos / city farms / open access farms or outdoor nurseries, the Health and Safety at Work Act 1974 and the COSHH regulations 2002 legislate for safe working practices within the UK; where there is a requirement for employers and employees to ensure that appropriate measures are in place to mitigate against known risks in the workplace. Whilst the HSE Agricultural Information Sheet (ASI\textsuperscript{23})\textsuperscript{7} focuses on open farms the advice on preventing infection applies to the countryside as a whole because the micro-organisms which may be contracted e.g. *E. coli* O\textsubscript{157} are not restricted to farm premises.

Children attending petting zoos / city farms / open access farms and outdoor nurseries, especially those <5 years, are at increased risk of contracting *E. coli* O\textsubscript{157}; principally by hand carriage as a result of direct animal contact and indirect contact via contamination of the environment with animal faeces or faecal matter, which includes contaminated soil or water run-off. Other enteric pathogens, e.g. *Campylobacter* and *Salmonella*, also pose a risk to children, exacerbated by their frequent hand to mouth contact and poor understanding and performance of hand washing.

The most effective method for preventing the acquisition of gastrointestinal pathogens, including *E. coli* O\textsubscript{157} is effective hand washing and the safe disposal of stools (faeces). The efficacy of ABHR / non-ABHR / hand wipes in the absence of hand washing is unproven, and while ABHR may be a useful adjunct to effective hand washing it is not an acceptable substitute especially when hands are visibly soiled.

Handwashing is a learnt behaviour and therefore children need to recognise when to wash their hands and understand why it is important to wash their hands correctly. To do this they need help from their parents, carers, teachers and adults in the childcare setting. Scotland’s National Hand Hygiene Campaign ‘Germs. Wash your hands of them.’ developed a Children’s Pack for children between the ages of three and six.
which includes materials to encourage children to make hand washing part of their everyday routine. [http://www.washyourhandsofthem.com/the-campaign/childrens-pack.aspx](http://www.washyourhandsofthem.com/the-campaign/childrens-pack.aspx)

Based on the assessment of the literature and the summary above, the following recommendation is proposed for hand hygiene in the outdoor nursery setting:

**Hand washing with soap and running water should be performed:**

- After using the toilet / changing a nappy
- Before and after eating, drinking or preparing food
- After sneezing, nose blowing or coughing
- If hands are soiled/dirty
- Before going home

ABHR should only be used as an adjunct to hand washing.


Appendix 1:

Overview of SIGN Grade of Recommendation (for a collection of papers or studies on the same topic area)

A At least one meta-analysis, systematic review, or RCT rated as 1++, and directly applicable to the target population; or
A body of evidence consisting principally of studies rated as 1+, directly applicable to the target population, and demonstrating overall consistency of results

B A body of evidence including studies rated as 2++, directly applicable to the target population, and demonstrating overall consistency of results; or
Extrapolated evidence from studies rated as 1++ or 1+

C A body of evidence including studies rated as 2+, directly applicable to the target population and demonstrating overall consistency of results; or
Extrapolated evidence from studies rated as 2++

D Evidence level 3 or 4; or
Extrapolated evidence from studies rated as 2+

Good Practice Points

√ Recommended best practice based on the clinical experience of the guideline development group


SIGN levels of evidence (for individual papers or studies)

1++
High quality meta-analyses, systematic reviews of RCTs, or RCTs with a very low risk of bias

1+
Well-conducted meta-analyses, systematic reviews, or RCTs with a low risk of bias

1-
Meta-analyses, systematic reviews, or RCTs with a high risk of bias

2++
High quality systematic reviews of case control or cohort studies
High quality case control or cohort studies with a very low risk of confounding or bias and a high probability that the relationship is causal
2+  
Well-conducted case control or cohort studies with a low risk of confounding or bias and a moderate probability that the relationship is causal

2-  
Case control or cohort studies with a high risk of confounding or bias and a significant risk that the relationship is not causal

3  
Non-analytic studies, e.g. case reports, case series

4  
Expert opinion
Appendix 2: Search Strategy

Database: Ovid MEDLINE(R) <1950 to June Week 2 2010>

Search Strategy:

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1    handwashing/
2    (hand adj1 (hygiene or washing or clean$ or decontamination or disinfection)).tw.
3    ABHR.tw.
4    ABHS.tw.
5    Soaps/
6    alcohols/ and gels/
7    alcohols/ and rubs.tw.
8    antiseptics.tw.
9    disinfectants/
10   anti-infective agents, local/
11   ((hand or baby) adj1 wipe$).tw.
12   ((hand adj1 (hygiene or washing or clean$ or decontamination or disinfection)) and (technique or method or practice or procedure)).tw.
13   toilet facilities/
14   schools, nursery/
15   child care/
16   nurseries/
17   child day care centers/
18   kindergar*en.tw.
19   playgroup.tw.
20   child/
21   child, preschool/
22   (or/1-13) and (or/14-21)
23   limit 22 to (english language and humans and yr="2000 -Current")
Legend:

$ = truncated term; * = single character truncation; tw = text word; adj2 = terms should occur within two words of each other; l = subject heading

The following online resources were also searched in order to identify any relevant policy or guidance documents or any significant grey literature:

- Health and Safety Executive
- The Stationary Office (OPSI)
- Centers for Disease Control and Prevention (CDC)
- Health Protection Agency (HPA)
- World Health Organization (WHO)

Health protection experts were also consulted to identify any other potentially useful sources of information.