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HUMAN PAPILOMAVIRUS

PATHOGEN SAFETY DATA SHEET - INFECTIOUS SUBSTANCES

SECTION I - INFECTIOUS AGENT

NAME: Human papillomavirus

SYNONYM OR CROSS REFERENCE: HPV, cervical cancer, cervical and uterine carcinoma, cervical dysplasia, genital warts (condyloma acuminatum, venereal warts, anal and anogenital warts), the common wart (*verruca vulgaris*), papilloma venereum, the common types are 6, 11, 16, 18, 31, 45, and 58.

CHARACTERISTICS: Part of the Papillomaviridae family, HPV is a closed circular double-stranded DNA virus located in a non-enveloped, icosahedral capsid that is 55 nm in diameter^(1,2). Over 100 types of HPV have been identified, 80 types have been sequenced, and it is believed that over 200 types exist based on partially sequenced fragments⁽³⁾. It is a very common sexually transmitted disease, with over 50 different types causing anogenital infections⁽⁴⁾. Of those, 25 are proven or likely human carcinogens⁽⁵⁾.

SECTION II - HAZARD IDENTIFICATION

PATHOGENICITY/TOXICITY: HPV viruses infect the basal epithelial cells of cutaneous and mucosal keratinized epithelia. Cutaneous infections affect most commonly the hands and feet, while mucosal infections target the lining of the mouth (small nodules can develop into cancerous cells), throat, respiratory tract, and anogenital epithelium⁽¹⁾. When mucosal infections do not clear spontaneously on their own, they can progress into cervical intraepithelial neoplasm, which can lead to cervical cancer⁽⁶⁾. IARC has identified 25 proven or likely high-risk types, including HPV 16, 18, 31, 33, 35, 39, 45, 58, which can lead to head, neck, and mucosal anogenital cancers⁽⁵⁾. All cervical cancers and 4% of all cancers are the result of HPV infections^(6,7). Low-risk genotypes, such as 6 and 11, can cause benign or low-grade cervical tissue damage and warts (including common, genital, and anogenital) in regions of the cervix, vagina, vulva, anus, penis, or scrotum⁽⁸⁾; however, 90% of infection with both high risk and low risk types clear spontaneously within 2 years and most are asymptomatic.

EPIDEMIOLOGY: HPV infections are common worldwide, with higher prevalence in certain population and regions, such as sub-Saharan Africa, south-central and south-east Asia, Latin America, and the Caribbean⁽⁸⁾. It is one of the most common sexually transmitted diseases in North America, with prevalence as high as 25 million cases, and 1 - 5.5 million new cases occurring per year in the United States^(1,9,10). Infection with genital warts is especially prevalent in the 18 - 30 age group⁽⁶⁾.

HOST RANGE: Observed in humans only, papillomaviruses are completely species-specific⁽⁶⁾.

INFECTIOUS DOSE: Unknown.

MODE OF TRANSMISSION: Infectious cells can be transmitted through direct virus-cell contact, such as skin-skin contact, sexual activity, and prolonged exposure to contaminated clothing as the virus may be carried on fomites⁽¹⁾. Transmission can also occur from mother-to-newborn through vertical transmission, albeit rarely⁽¹¹⁾.

INCUBATION PERIOD: Unclear as it can vary from one month to several years, but it is usually 3 weeks to 8 months, and most warts develop 2 - 3 months after infection⁽⁹⁾; however, most cases of infections will never show any symptoms⁽⁸⁾.

COMMUNICABILITY: Visible presence of genital warts can increase chances of infection dramatically, as 65% of people who have come in contact with the warts will develop them as well⁽⁹⁾.

SECTION III - DISSEMINATION

RESERVOIR: Humans⁽⁶⁾.

ZOONOSIS: None.

VECTORS: None.

SECTION IV - STABILITY AND VIABILITY

DRUG SUSCEPTIBILITY: HPV is not susceptible to antiviral drugs. Topical treatment using trichloacetic acid, ammonium trichloro (dioxoethylene-O,O') tellurate (AS101), and podophyllin on external vulval and perianal warts has been found to be effective with low reoccurrence rate⁽¹²⁾. The immunostimulant imiquimod is also an effective local treatment of genital warts.

DRUG RESISTANCE: HPV is resistant to most antiviral agents as there is no complete cure to date, and chances of reoccurrence are high⁽¹²⁾.

SUSCEPTIBILITY TO DISINFECTANTS: Exposure to 90% ethanol for at least 1 minute, 2% glutaraldehyde, 30% Savlon, and/or 1% sodium hypochlorite can disinfect the pathogen^(10,13).

PHYSICAL INACTIVATION: Varies with different strains; sensitive to UV- irradiation, heating to 100 °C is sufficient for inactivation⁽¹⁰⁾.

SURVIVAL OUTSIDE HOST: HPV is resistant to heat and drying, and is able to survive on inanimate objects such as clothing and laboratory equipment that have come in contact with infected patients, although the precise survival time is unknown^(1,11).

SECTION V - FIRST AID / MEDICAL

SURVEILLANCE: Mild changes in the epithelium caused by HPV infections can be detected by virological and cytological techniques⁽⁸⁾. Abnormal growth of squamous intraepithelial lesions (SIL) can be identified using cytological examinations of cervical or anal smears (Pap test), and histological examination of cervical or anal biopsies can be used to detect intraepithelial neoplasia (CIN or AIN). Persistent infection can result in the virus integrating into human DNA, causing cancer precursors, which can lead to ano- genital and head-and-neck cancers if untreated. Detection of HPV DNA can also be used to detect infection in women and men⁽¹⁴⁾.

Note: All diagnostic methods are not necessarily available in all countries.

FIRST AID/TREATMENT: No first aid treatment is available. Liquid nitrogen can be used for treatment against warts.

IMMUNISATION: The quadrivalent HPV vaccine Gardasil (types 6, 11, 16, 18) and the divalent vaccine Cervarix (16 and 18) have been found to be very effective in decreasing prevalence of types 6, 11, 16, and 18 genital lesions in boys between 9-15 years of age and women between 18-26 years of age. Gardasil is also effective in males between 18- 26 years of age, and can also be used by females^(9,15). The vaccine contains papillomavirus-like particles (empty shells of viral structural proteins) that produce a neutralizing antibody response, which is believed to prevent papillomavirus from infecting host cells⁽¹⁶⁾. It also displays efficacy against condyloma and penile intraepithelial neoplasia. Gardasil and Cervarix are the only two HPV vaccines approved for use in Canada.

PROPHYLAXIS: Promising virus-like particle (VLP) vaccines, which are protein shells of HPV without infective DNA, can induce high titers of type-specific antibody. Prophylactic VLP seeks to elicit neutralizing antibody, and would be ideally targeted to adolescent women prior to sexual intercourse⁽¹⁷⁾. Gardasil and Cervarix prevent infection of the four most common forms of HPV, including types 16 and 18 which can cause cervical cancers⁽¹⁸⁾. Spreading awareness and knowledge of the risks posed by HPV can increase self protection and lower prevalence of infection⁽¹⁹⁾. Screening for and removal of cervical high grade lesions is a very effective way to prevent invasive cancer in women.

SECTION VI - LABORATORY HAZARDS

LABORATORY -ACQUIRED INFECTIONS : None reported to date.

SOURCES/SPECIMENS: Warts on perianal or common skin infected outer skin tissues, and melanoma biopsy tissues^(9,20).

PRIMARY HAZARDS: Accidental skin contact with infected wart tissue may lead to development of common wart (*verruca vulgaris*), due to benign cutaneous HPV types⁽²¹⁾. Accidental transmission of genital HPVs from clinical specimens has not been reported and it should be considered very unlikely.

SPECIAL HAZARDS: None.

SECOND VII - EXPOSURE CONTROLS / PERSONAL PROTECTION

RISK GROUP CLASSIFICATION: Risk Group 2⁽²²⁾.

CONTAINMENT REQUIREMENTS: Containment Level 2 facilities, equipment, and operational practices for work involving infectious or potentially infectious materials, animals, or cultures.

PROTECTIVE CLOTHING: Lab coat. Gloves when direct skin contact with infected materials or animals is unavoidable. Eye protection must be used where there is a known or potential risk of exposure to splashes⁽²³⁾.

OTHER PRECAUTIONS: All procedures that may produce aerosols, or involve high concentrations or large volumes should be conducted in a biological safety cabinet (BSC). The use of needles, syringes, and other sharp objects should be strictly limited. Additional precautions should be considered with work involving animals or large scale activities⁽²³⁾.

SECTION VIII - HANDLING AND STORAGE

SPIILLS: Allow aerosols to settle. While wearing protective clothing, cover spill with absorbent paper towel. Apply appropriate disinfectant, and starting from perimeter and wipe towards the center. Allow sufficient contact time before cleaning up.

DISPOSAL: Decontaminate all wastes that contain or have come in contact with the infectious organism before disposing by autoclave, chemical disinfection, gamma irradiation, or incineration⁽²³⁾.

STORAGE: Properly labelled and sealed containers.

SECTION IX - REGULATORY AND OTHER INFORMATION

REGULATORY INFORMATION: The import, transport, and use of pathogens in Canada is regulated under many regulatory bodies, including the Public Health Agency of Canada, Health Canada, Canadian Food Inspection Agency, Environment Canada, and Transport Canada. Users are responsible for ensuring they are compliant with all relevant acts, regulations, guidelines, and standards.

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PREPARED BY: Pathogen Regulation Directorate, Public Health Agency of Canada Although the information, opinions and recommendations contained in this Pathogen Safety Data Sheet are compiled from sources believed to be reliable, we accept no responsibility for the accuracy, sufficiency, or reliability or for any loss or injury resulting from the use of the information. Newly discovered hazards are frequent and this information may not be completely up to date.

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