INTRODUCTION
Cervical cancer is the fourth most common cancer in women, worldwide leading to over 300,000 deaths per year.1 Introduction of screening programs has allowed for an increased detection of pre-cancer lesions, resulting in a 50% reduction of premature deaths. Yet, non-attendance rates are high: on average 40% of women living in developed countries are not participating in screening, and 80% in developing countries.5

The golden standard to screen for pre-cancer lesions has been cytologic evaluation based on clinician-taken cervical smears. Reasons for reluctance to gynecological examinations are the relative invasive character of cervical sampling, ethnicity and culture, lack of time and the need to visit a clinician. The principal cause of cervical cancer are high-risk infections with the human papillomavirus (HPV) and a significant evidence-base has been established to indicate that HPV-based cervical cancer screening is more effective and efficient.1

This is where Novosanis’ Colli-Pee®, a user-friendly, self-sampling urine-capturing device fits in with the opportunity to offer a complete molecular approach towards cervical cancer screening. Colli-Pee® collects first-void urine (first 20 mL of urine flow) for the detection of HPV infections. The same sample also has great potential for molecular-based triage testing to differentiate between a transient productive infection and a persistent transforming infection.4

STANDARDIZED FIRST-VOID AND VOLUMETRIC URINE SELF-SAMPLING
First-void urine contains washed away mucus and debris from exfoliated superficial cell layers of a cervix carcinoma. Colli-Pee® allows for volumetric and standardized collection of first-void urine and different variants enable collection of different volumes ranging from 45 mL to 4 mL. The volumetric collection capabilities of the device have been measured - 84.8% and 89.4% of the collected samples are within the specified range of 20±2 mL and 10±1 mL respectively.5 This is significantly more standardized compared to a regular urine cup, where collected sample volumes are only 15.1% within the specified range. Moreover, Colli-Pee® outperforms a regular urine cup with regards to the number of both human and HPV DNA copies found in urine.5 This is illustrated on Figure 1 for HPV 16 DNA copies specifically.

Novosanis’ usability study also showed that Colli-Pee® is a well-accepted solution for home-based collection: 96% of users rated the device as easy-to-use and 87% preferred postal delivery to visiting a physician.3

FEASIBILITY OF COMMERCIAL AVAILABLE DIAGNOSTIC ASSAYS
Several pilot studies confirmed feasibility of HPV DNA detection in first-void urine with commercially available diagnostic assays for automated screening (Roche Cobas® HPV, BD Onclarity® HPV, AptaMax® HPV Hologic Panther, Cepheid Xpert® HPV) or genotyping (Genefirst Papilloplex® HR-HPV, Anyplex™ II HPV HR Seenge, Fujirebio Innolipa® HPV, High+Low Papillomastrip Operon).6,7,8,9,10,11,12

These studies have been carried out with Colli-Pee® prefilled with Urine Conservation Medium (UCM®), enabling general urine preservation for transport and storage at ambient temperature for up to 7 days.12 Detection of HPV DNA in Colli-Pee® collected first-void urine was assessed with commercial, diagnostic assays and both an in-house and a commercially available genotyping assay as a reference.

NucliSENS® easyMag® extraction was used for analysis with the two comparator assays that were developed to provide maximal analytical sensitivity: (a) a lab developed HPV type specific qPCR method i.e. the Riatol assay (UAntwerp, Belgium) and (b) the Optiplex HPV genotyping kit (Diamex, Germany).

Concordance between the tested and comparator assays show a high level of agreement for genotyping tests with kappa-values ranging from 0.67 to 0.82.12,13,14 Automated screening assays also demonstrate fair to good concordance with kappa-values ranging from 0.24 to 0.76 for detection of all HPV types.12,14,15,16 When HPV 16 and HPV 18, the most commonly detected high-risk types in cervical cancer, were under investigation, kappa-values slightly increased i.e. 0.56 to 0.73.14,15,16 This already shows the clinical feasibility of first-void urine in primary screening.

CLINICAL PERFORMANCE DATA FROM COLPOSCOPY REFERRAL POPULATIONS
Several clinical trials have been set-up, in more than 2500 women referred to colposcopy, to address the performance of Colli-Pee® collected first-void urine to other self-sampling devices for HPV detection and understand its potential in cervical cancer screening.

The EVAH study, using the analytically sensitive SPF10-DEIA-LiPA25 assay and the clinically validated GP5+/6+ assay (EIA) for HPV detection, showed that urine samples collected with Colli-Pee® enabled almost perfect detection of HPV infections in women with CIN2+ lesions.17 This is illustrated on Figure 2 by an absolute sensitivity ranging from 95% to 100%. The quality of clinician-taken smear and a vaginal swab self-sample were also assessed within the EVAH study. These samples provided perfect sensitivity, similar to first-void urine collected with Colli-Pee®.

Figure 1
Boxplots of HPV 16 DNA copies, for all patients where an infection with HPV 16 was detected, found in Colli-Pee® versus copies found in a urine cup.
The CASU trial also investigates the impact of collection volume of our new variants (10 mL and 4 mL) and DNA extraction method on the detection of biomarkers and HPV DNA in first-void urine. First data showed an overall good agreement between the three different first-void urine collection volumes for human DNA and HPV DNA endpoints. Consequently, the Colli-Pee® Small Volumes variant was selected for the remainder of the study as it is compatible with high-throughput instruments and postal delivery, offering potential for high-throughput screening and home-based sample collection.

For more information: www.novosanis.com