

Supplementary material

1. Nucleotide changes among E6/E7 variants of HR-HPV. Nucleotide sequences were obtained from Papillomavirus Episteme (PaVE) portal [69], then NCBI accession number of each variant was used to analyzed E6/E7 bicistronic sequence and Clustal Omega (v 1.2.4) was used for E6/E7 alignments of **A)** HPV-16; and **B)** HPV-18 variants. E6 and E7 ORF reference genome are depicted in pink and yellow, respectively. Moreover, nucleotide changes of each variant are shown in green; and asterisk (*) represent similitudes in nucleotide sequence among variants while empty spaces represent changes among variants in relation to reference genome. According to sequences obtained from NCBI, broken lines indicate differences in the start coding sites among variants.

A) Nucleotide alignments of E6/E7 HPV-16 variants

Sublineage	Nucleotide sequence E6/E7 HPV-16 bicistron	Position
A4	ATGCACCAAAAGAGAACTGCAATGTTTCAGGACCCACAGGAGCGACCCAGAAAGTTACCA	60
A3	-----ATGTTTCAGGACCCACAGGAGCGACCCAGAAAGTTACCA	39
A1	ATGCACCAAAAGAGAACTGCAATGTTTCAGGACCCACAGGAGCGACCCAGAAAGTTACCA	60
A2	ATGCACCAAAAGAGAACTGCAATGTTTCAGGACCCACAGGAGCGACCCGAAAGTTACCA	60
C1	ATGCACCAAAAGAGAACTGCAATGTTTCAGGACCCACAGGAGCGACCCATAAAGTTACCA	60
D2	ATGCACCAAAAGAGAACTGCAATGTTTCAGGACCCACAGGAGCGACCCAGAAAGTTACCA	60
D3	ATGCACCAAAAGAGAACTGCAATGTTTCAGGACCCACAGGAGCGACCCAGAAAGTTACCA	60
D1	-----ATGTTTCAGGACCCACAGGAGCGACCCAGAAAGTTACCA	39
D4	-----ATGTTTCAGGACCCACAGGAGCGACCCAGAAAGTTACCA	39
C2	-----ATGTTTCAGGACCCACAGGAGCGACCCAGAAAGTTACCA	39
B4	-----ATGTTTCAGGACCCACAGGAGCGACCCGAAAGTTACCA	39
B2	-----ATGTTTCAGGACCCACAGGAGCGACCCGAAAGTTACCA	39
C4	-----ATGTTTCAGGACCCACAGGAGCGACCCAGAAAGTTACCA	39
B3	-----ATGTTTCAGGACCCACAGGAGCGACCCAGAAAGTTACCA	39
B1	CTGCACCAAAAGAGAACTGCAATGTTTCAGGACCCACAGGAGCGACCCACAAAGTTACCA	60
C3	-----ATGTTTCAGGACCCACAGGAGCGACCCAGAAAGTTACCA	39

Sublineage	Nucleotide sequence E6/E7 HPV-16 bicistron	Position
A4	CAGTTATGCACAGAGCTGCAAACAACCTATACATGAGATAATATTAGAATGTGTGTACTGC	120
A3	CAGTTATGCACAGAGCTGCAAACAACCTATACATGATATAATATTAGAATGTGTGTACTGC	99
A1	CAGTTATGCACAGAGCTGCAAACAACCTATACATGATATAATATTAGAATGTGTGTACTGC	120
A2	CAGTTATGCACAGAGCTGCAAACAACCTATACATGATATAATATTAGAATGTGTGTACTGC	120
C1	GATTTATGCACAGAGCTGCAAACAACCTATACATGATATAATATTAGAATGTGTGTACTGC	120
D2	CATTTATGCACAGAGCTGCAAACAACCTATACATGATATAATATTAGAATGTGTGTACTGC	120
D3	CATTTATGCACAGAGCTGCAAACAACCTATACATGATATAATATTAGAATGTGTGTACTGC	120
D1	CATTTATGCACAGAGCTGCAAACAACCTATACATGATATAATATTAGAATGTGTGTACTGC	99
D4	CATTTATGCACAGAGCTGCAAACAACCTATACATGATATAATATTAGAATGTGTGTACTGC	99
C2	GATTTATGCACAGAGCTGCAAACAACCTATACATGATATAATATTAGAATGTGTGTACTGC	99
B4	GATTTATGCACAGAGCTGCAAACAACCTATACATGATATAATATTAGAATGTGTGTACTGC	99
B2	GATTTATGCACAGAGCTGCAAACAACCTATACATGATATAATATTAGAATGTGTGTACTGC	99
C4	GATTTATGCACAGAGCTGCAAACAACCTATACATGATATAATATTAGAATGTGTGTACTGC	99
B3	GATTTATGCACAGAGCTGCAAACAACCTATACATGATATAATATTAGAATGTGTGTACTGC	99
B1	GATTTATGCACAGAGCTGCAAACAACCTATACATGATATAATATTAGAATGTGTGTACTGC	120
C3	GATTTATGCACAGAGCTGCAAACAACCTATACATGATATAATATTAGAATGTGTGTACTGC	99
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Sublineage	Nucleotide sequence E6/E7 HPV-16 bicistron	Position
A4	AAGCAACAGTTACTGCGACGTGAGGTATATGACTTTTGCTTTTCGGGATTTATGCATAGTA	180
A3	AAGCAACAGTTACTGCGACGTGAGGTATATGACTTTTGCTTTTCGGGATTTATGCATAGTA	159
A1	AAGCAACAGTTACTGCGACGTGAGGTATATGACTTTTGCTTTTCGGGATTTATGCATAGTA	180

A2	AAGCAACAGTTACTGCGACGTGAGGTATATGACTTTTGCTTTTCGGGATTTATGCATAGTA	180
C1	AAGCAACAGTTACTGCGACGTGAGGTATATGACTTTTGCTTTTCGGGATTTATGCATAGTA	180
D2	AAGCAACAGTTACTGCGACGTGAGGTATATGACTTTTGCTTTTCGGGATTTATGCATAGTA	180
D3	AAGCAACAGTTACTGCGACGTGAGGTATATGACTTTTGCTTTTCGGGATTTATGCATAGTA	180
D1	AAGCAACAGTTACTGCGACGTGAGGTATATGACTTTTGCTTTTCGGGATTTATGCATAGTA	159
D4	AAGCAACAGTTACTGCGACGTGAGGTATATGACTTTTGCTTTTCGGGATTTATGCATAGTA	159
C2	AAGCAACAGTTACTGCGACGTGAGGTATATGACTTTTGCTTTTCGGGATTTATGCATAGTA	159
B4	AAGCAACAGTTACTGCGACGTGAGGTATATGACTTTTGCTTTTCGGGATTTATGCATAGTA	159
B2	AAGCAACAGTTACTGCGACGTGAGGTATATGACTTTTGCTTTTCGGGATTTATGCATAGTA	159
C4	AAGCAACAGTTACTGCGACGTGAGGTATATGACTTTTGCTTTTCGGGATTTATGCATAGTA	159
B3	AAGCAACAGTTACTGCGACGTGAGGTATATGACTTTTGCTTTTCGGGATTTATGCATAGTA	159
B1	AAGCAACAGTTACTGCGACGTGAGGTATATGACTTTTGCTTTTCGGGATTTATGCATAGTA	180
C3	AAGCAACAGTTACTGCGACGTGAGGTATATGACTTTTGCTTTTCGGGATTTATGCATAGTA	159

Sublineage	Nucleotide sequence E6/E7 HPV-16 bicistron	Position
A4	TATAGAGATGGGAATCCATATGCTGTATGTGATAAAATGTTTAAAGTTTTATTCTAAAATT	240
A3	TATAGAGATGGGAATCCATATGCTGTATGTGATAAAATGTTTAAAGTTTTATTCTAAAATT	219
A1	TATAGAGATGGGAATCCATATGCTGTATGTGATAAAATGTTTAAAGTTTTATTCTAAAATT	240
A2	TATAGAGATGGGAATCCATATGCTGTATGTGATAAAATGTTTAAAGTTTTATTCTAAAATT	240
C1	TATAGAGATGGGAATCCATATGCAGTGTGTGATAAAATGTTTAAAGTTTTATTCTAAAATT	240
D2	TATAGAGATGGGAATCCATATGCAGTGTGTGATAAAATGTTTAAAGTTTTATTCTAAAATT	240
D3	TATAGAGATGGGAATCCATATGCAGTGTGTGATAAAATGTTTAAAGTTTTATTCTAAAATT	240
D1	TATAGAGATGGGAATCCATATGCAGTGTGTGATAAAATGTTTAAAGTTTTATTCTAAAATT	219
D4	TATAGAGATGGGAATCCATATGCAGTGTGTGATAAAATGTTTAAAGTTTTATTCTAAAATT	219
C2	TATAGAGATGGGAATCCATATGCAGTGTGTGATAAAATGTTTAAAGTTTTATTCTAAAATT	219
B4	TATAGAGATGGGAATCCATATGCAGTGTGTGATAAAATGTTTAAAGTTTTATTCTAAAATT	219
B2	TATAGAGATGGGAATCCATATGCAGTGTGTGATAAAATGTTTAAAGTTTTATTCTAAAATT	219
C4	TATAGAGATGGGAATCCATATGCAGTGTGTGATAAAATGTTTAAAGTTTTATTCTAAAATT	219
B3	TATAGAGATGGGAATCCATATGCAGTGTGTGATAAAATGTTTAAAGTTTTATTCTAAAATT	219
B1	TATAGAGATGGGAATCCATATGCAGTGTGTGATAAAATGTTTAAAGTTTTATTCTAAAATT	240
C3	TATAGAGATGGGAATCCATATGCAGTGTGTGATAAAATGTTTAAAGTTTTATTCTAAAATT	219

Sublineage	Nucleotide sequence E6/E7 HPV-16 bicistron	Position
A4	AGTGAGTATAGACATTATTGTTATAGTTTGTATGGAACAACATTAGAACAGCAATACAAC	300
A3	AGTGAGTATAGACATTATTGTTATAGTTTGTATGGAACAACATTAGAACAGCAATACAAC	279
A1	AGTGAGTATAGACATTATTGTTATAGTTTGTATGGAACAACATTAGAACAGCAATACAAC	300
A2	AGTGAGTATAGACATTATTGTTATAGTTTGTATGGAACAACATTAGAACAGCAATACAAC	300
C1	AGTGAGTATAGACATTATTGTTATAGTTTGTATGGAACAACATTAGAACAGCAATACAAC	300
D2	AGTGAGTATAGACATTATTGTTATAGTTTGTATGGAACAACATTAGAACAGCAATACAAC	300
D3	AGTGAGTATAGACATTATTGTTATAGTTTGTATGGAACAACATTAGAACAGCAATACAAC	300
D1	AGTGAGTATAGACATTATTGTTATAGTTTGTATGGAACAACATTAGAACAGCAATACAAC	279
D4	AGTGAGTATAGACATTATTGTTATAGTTTGTATGGAACAACATTAGAACAGCAATACAAC	279
C2	AGTGAGTATAGACATTATTGTTATAGTTTGTATGGAACAACATTAGAACAGCAATACAAC	279
B4	AGTGAGTATAGACATTATTGTTATAGTTTGTATGGAACAACATTAGAACAGCAATACAAC	279
B2	AGTGAGTATAGACATTATTGTTATAGTTTGTATGGAACAACATTAGAACAGCAATACAAC	279
C4	AGTGAGTATAGACATTATTGTTATAGTTTGTATGGAACAACATTAGAACAGCAATACAAC	279
B3	AGTGAGTATAGACATTATTGTTATAGTTTGTATGGAACAACATTAGAACAGCAATACAAC	279
B1	AGTGAGTATAGACATTATTGTTATAGTTTGTATGGAACAACATTAGAACAGCAATACAAC	300
C3	AGTGAGTATAGACATTATTGTTATAGTTTGTATGGAACAACATTAGAACAGCAATACAAC	279

Sublineage	Nucleotide sequence E6/E7 HPV-16 bicistron	Position
A4	AAACCGTTGTGTGATTTGTTAATTAGGTGTATTAAGTGTCAAAGCCACTGTGTCCTGAA	360
A3	AAACCGTTGTGTGATTTGTTAATTAGGTGTATTAAGTGTCAAAGCCACTGTGTCCTGAA	339

A1	AAACCGTTGTGTGATTTGTTAATTAGGTGTATTAAGTGTCAAAAAGCCACTGTGTCCTGAA	360
A2	AAACCGTTGTGTGATTTGTTAATTAGGTGTATTAAGTGTCAAAAAGCCACTGTGTCCTGAA	360
C1	AAACCGTTGTGTGATTTGTTTATTAGGTGTATTAAGTGTCAAAAAGCCACTGTGTCCTGAA	360
D2	AAACCGTTGTGTGATTTGTTAATTAGGTGTATTAAGTGTCAAAAAGCCACTGTGTCCTGAA	360
D3	AAACCGTTGTGTGATTTGTTAATTAGGTGTATTAAGTGTCAAAAAGCCACTGTGTCCTGAA	360
D1	AAACCGTTGTGTGATTTGTTAATTAGGTGTATTAAGTGTCAAAAAGCCACTGTGTCCTGAA	339
D4	AAACCGTTGTGTGATTTGTTAATTAGGTGTATTAAGTGTCAAAAAGCCACTGTGTCCTGAA	339
C2	AAACCGTTGTGTGATTTGTTAATTAGGTGTATTAAGTGTCAAAAAGCCACTGTGTCCTGAA	339
B4	AAACCGTTGTGTGATTTGTTAATTAGGTGTATTAAGTGTCAAAAAGCCACTGTGTCCTGAA	339
B2	AAACCGTTGTGTGATTTGTTAATTAGGTGTATTAAGTGTCAAAAAGCCACTGTGTCCTGAA	339
C4	AAACCGTTGTGTGATTTGTTAATTAGGTGTATTAAGTGTCAAAAAGCCACTGTGTCCTGAA	339
B3	AAACCGTTGTGTGATTTGTTAATTAGGTGTATTAAGTGTCAAAAAGCCACTGTGTCCTGAA	339
B1	AAACCGTTGTGTGATTTGTTAATTAGGTGTATTAAGTGTCAAAAAGCCACTGTGTCCTGAA	360
C3	AAACCGTTGTGTGATTTGTTAATTAGGTGTATTAAGTGTCAAAAAGCCACTGTGTCCTGAA	339

Sublineage	Nucleotide sequence E6/E7 HPV-16 bicistron	Position
A4	GAAAAGCAAAGACATCTGGACAAAAAGCAAAGATTCCATAATATAAGGGGTCGGTGGACC	420
A3	GAAAAGCAAAGACATCTGGACAAAAAGCAAAGATTCCATAATATAAGGGGTCGGTGGACC	399
A1	GAAAAGCAAAGACATCTGGACAAAAAGCAAAGATTCCATAATATAAGGGGTCGGTGGACC	420
A2	GAAAAGCAAAGACATCTGGACAAAAAGCAAAGATTCCATAATATAAGGGGTCGGTGGACC	420
C1	GAAAAGCAAAGACATCTGGACAAAAAGCAAAGATTCCATAATATAAGGGGTCGGTGGACC	420
D2	GAAAAGCAAAGACATCTGGACAAAAAGCAAAGATTCCATAATATAAGGGGTCGGTGGACC	420
D3	GAAAAGCAAAGACATCTGGACAAAAAGCAAAGATTCCATAATATAAGGGGTCGGTGGACC	420
D1	GAAAAGCAAAGACATCTGGACAAAAAGCAAAGATTCCATAATATAAGGGGTCGGTGGACC	399
D4	GAAAAGCAAAGACATCTGGACAAAAAGCAAAGATTCCATAATATAAGGGGTCGGTGGACC	399
C2	GAAAAGCAAAGACATCTGGACAAAAAGCAAAGATTCCATAATATAAGGGGTCGGTGGACC	399
B4	GAAAAGCAAAGACATCTGGACAAAAAGCAAAGATTCCATAATATAAGGGGTCGGTGGACC	399
B2	GAAAAGCAAAGACATCTGGACAAAAAGCAAAGATTCCATAATATAAGGGGTCGGTGGACC	399
C4	GAAAAGCAAAGACATCTGGACAAAAAGCAAAGATTCCATAATATAAGGGGTCGGTGGACC	399
B3	GAAAAGCAAAGACATCTGGACAAAAAGCAAAGATTCCATAATATAAGGGGTCGGTGGACC	399
B1	GAAAAGCAAAGACATCTGGACAAAAAGCAAAGATTCCATAATATAAGGGGTCGGTGGACC	420
C3	GAAAAGCAAAGACATCTGGACAAAAAGCAAAGATTCCATAATATAAGGGGTCGGTGGACC	399

Sublineage	Nucleotide sequence E6/E7 HPV-16 bicistron	Position
A4	GGTCGATGTATGTCTTGTTGCAGATCATCAAGAACACGTAGAGAAACCCAGCTGTAATCA	480
A3	GGTCGATGTATGTCTTGTTGCAGATCATCAAGAACACGTAGAGAAACCCAGCTGTAATCA	459
A1	GGTCGATGTATGTCTTGTTGCAGATCATCAAGAACACGTAGAGAAACCCAGCTGTAATCA	480
A2	GGTCGATGTATGTCTTGTTGCAGATCATCAAGAACACGTAGAGAAACCCAGCTGTAATCA	480
C1	GGTCGATGTATGTCTTGTTGCAGATCATCAAGAACACGTAGAGAAACCCAGCTGTAATCA	480
D2	GGTCGATGTATGTCTTGTTGCAGATCATCAAGAACACGTAGAGAAACCCAGCTGTAATCA	480
D3	GGTCGATGTATGTCTTGTTGCAGATCATCAAGAACACGTAGAGAAACCCAGCTGTAATCA	480
D1	GGTCGATGTATGTCTTGTTGCAGATCATCAAGAACACGTAGAGAAACCCAGCTGTAATCA	459
D4	GGTCGATGTATGTCTTGTTGCAGATCATCAAGAACACGTAGAGAAACCCAGCTGTAATCA	459
C2	GGTCGATGTATGTCTTGTTGCAGATCATCAAGAACACGTAGAGAAACCCAGCTGTAATCA	459
B4	GGTCGATGTATGTCTTGTTGCAGATCATCAAGAACACGTAGAGAAACCCAGCTGTAATCA	459
B2	GGTCGATGTATGTCTTGTTGCAGATCATCAAGAACACGTAGAGAAACCCAGCTGTAATCA	459
C4	GGTCGATGTATGTCTTGTTGCAGATCATCAAGAACACGTAGAGAAACCCAGCTGTAATCA	459
B3	GGTCGATGTATGTCTTGTTGCAGATCATCAAGAACACGTAGAGAAACCCAGCTGTAATCA	459
B1	GGTCGATGTATGTCTTGTTGCAGATCATCAAGAACACGTAGAGAAACCCAGCTGTAATCA	480
C3	GGTCGATGTATGTCTTGTTGCAGATCATCAAGAACACGTAGAGAAACCCAGCTGTAATCA	459

Sublineage	Nucleotide sequence E6/E7 HPV-16 bicistron	Position
A4	TGCATGGAGATACACCTACATTGCATGAATATATGTTAGATTTGCAACCAGAGACAACCTG	540
A3	TGCATGGAGATACACCTACATTGCATGAATATATGTTAGATTTGCAACCAGAGACAACCTG	519
A1	TGCATGGAGATACACCTACATTGCATGAATATATGTTAGATTTGCAACCAGAGACAACCTG	540
A2	TGCATGGAGATACACCTACATTGCATGAATATATGTTAGATTTGCAACCAGAGACAACCTG	540
C1	TGCATGGAGATACACCTACATTGCATGAATATATGTTAGATTTGCAACCAGAGACAACCTG	540
D2	TGCATGGAGATACACCTACATTGCATGAATATATGTTAGATTTGCAACCAGAGACAACCTG	540
D3	TGCATGGAGATACACCTACATTGCATGAATATATGTTAGATTTGCAACCAGAGACAACCTG	540
D1	TGCATGGAGATACACCTACATTGCATGAATATATGTTAGATTTGCAACCAGAGACAACCTG	519
D4	TGCATGGAGATACACCTACATTGCATGAATATATGTTAGATTTGCAACCAGAGACAACCTG	519
C2	TGCATGGAGATACACCTACATTGCATGAATATATGTTAGATTTGCAACCAGAGACAACCTG	519
B4	TGCATGGAGATACACCTACATTGCATGAATATATGTTAGATTTGCAACCAGAGACAACCTG	519
B2	TGCATGGAGATACACCTACATTGCATGAATATATGTTAGATTTGCAACCAGAGACAACCTG	519
C4	TGCATGGAGATACACCTACATTGCATGAATATATGTTAGATTTGCAACCAGAGACAACCTG	519
B3	TGCATGGAGATACACCTACATTGCATGAATATATGTTAGATTTGCAACCAGAGACAACCTG	519
B1	TGCATGGAGATACACCTACATTGCATGAATATATGTTAGATTTGCAACCAGAGACAACCTG	540
C3	TGCATGGAGATACACCTACATTGCATGAATATATGTTAGATTTGCAACCAGAGACAACCTG	519

Sublineage	Nucleotide sequence E6/E7 HPV-16 bicistron	Position
A4	ATCTCTACTGTTATGAGCAATTAACTGCACAGCTCAGAGGAGGAGGATGAAATAGATGGTC	600
A3	ATCTCTACTGTTATGAGCAATTAAATGACAGCTCAGAGGAGGAATGATGAAATAGATGGTC	579
A1	ATCTCTACTGTTATGAGCAATTAAATGACAGCTCAGAGGAGGAGGATGAAATAGATGGTC	600
A2	ATCTCTACTGTTATGAGCAATTAAATGACAGCTCAGAGGAGGAGGATGAAATAGATGGTC	600
C1	ATCTCTACTGTTATGAGCAATTAACTGCACAGCTCAGAGGAGGAGGATGAAATAGATGGTC	600
D2	ATCTCTACTGTTATGAGCAATTAAATGACAGCTCAGAGGAGGAGGATGAAATAGATGGTC	600
D3	ATCTCTACTGTTATGAGCAATTAAATGACAGCTCAGAGGAGGAGGATGAAATAGATGGTC	600
D1	ATCTCTACTGTTATGAGCAATTAAATGACAGCTCAGAGGAGGAGGATGAAATAGATGGTC	579
D4	ATCTCTACTGTTATGAGCAATTAAATGACAGCTCAGAGGAGGAGGATGAAATAGATGGTC	579
C2	ATCTCTACTGTTATGAGCAATTAAATGACAGCTCAGAGGAGGAGGATGAAATAGATGGTC	579
B4	ATCTCTACTGTTATGAGCAATTAAATGACAGCTCAGAGGAGGAGGATGAAATAGATGGTC	579
B2	ATCTCTACTGTTATGAGCAATTAACTGCACAGCTCAGAGGAGGAGGATGAAATAGATGGTC	579
C4	ATCTCTACTGTTATGAGCAATTAAATGACAGCTCAGAGGAGGAGGATGAAATAGATGGTC	579
B3	ATCTCTACTGTTATGAGCAATTAAATGACAGCTCAGAGGAGGAGGATGAAATAGATGGTC	579
B1	ATCTCTACTGTTATGAGCAATTAAATGACAGCTCAGAGGAGGAGGATGAAATAGATGGTC	600
C3	ATCTCTACTGTTATGAGCAATTAAATGACAGCTCAGAGGAGGAGGATGAAATAGATGGTC	579

Sublineage	Nucleotide sequence E6/E7 HPV-16 bicistron	Position
A4	CAGCTGGACAAGCAGAACCGGACAGAGCCCATTACAATATTGTAACCTTTTGTGCAAGT	660
A3	CAGCTGGACAAGCAGAACCGGACAGAGCCCATTACAATATTGTAACCTTTTGTGCAAGT	639
A1	CAGCTGGACAAGCAGAACCGGACAGAGCCCATTACAATATTGTAACCTTTTGTGCAAGT	660
A2	CAGCTGGACAAGCAGAACCGGACAGAGCCCATTACAATATTGTAACCTTTTGTGCAAGT	660
C1	CAGCTGGACAAGCAGAACCGGACAGAGCCCATTACAATATTGTAACCTTTTGTGCAAGT	660
D2	CAGCTGGACAAGCAGAACCGGACAGAGCCCATTACAATATTGTAACCTTTTGTGCAAGT	660
D3	CAGCTGGACAAGCAGAACCGGACAGAGCCCATTACAATATTGTAACCTTTTGTGCAAGT	660
D1	CAGCTGGACAAGCAGAACCGGACAGAGCCCATTACAATATTGTAACCTTTTGTGCAAGT	639
D4	CAGCTGGACAAGCAGAACCGGACAGAGCCCATTACAATATTGTAACCTTTTGTGCAAGT	639
C2	CAGCTGGACAAGCAGAACCGGACAGAGCCCATTACAATATTGTAACCTTTTGTGCAAGT	639
B4	CAGCTGGACAAGCAGAACCGGACAGAGCCCATTACAATATTGTAACCTTTTGTGCAAGT	639
B2	CAGCTGGACAAGCAGAACCGGACAGAGCCCATTACAATATTGTAACCTTTTGTGCAAGT	639
C4	CAGCTGGACAAGCAGAACCGGACAGAGCCCATTACAATATTGTAACCTTTTGTGCAAGT	639
B3	CAGCTGGACAAGCAGAACCGGACAGAGCCCATTACAATATTGTAACCTTTTGTGCAAGT	639
B1	CAGCTGGACAAGCAGAACCGGACAGAGCCCATTACAATATTGTAACCTTTTGTGCAAGT	660

C3 CAGCTGGACAAGCAGAACCGGACAGAGCCCATTACAATATTGTAACCTTTTGTGCAAGT 639

Sublineage	Nulceotide sequence E6/E7 HPV-16 bicistron	Position
A4	GTGACTCTACGCTTCGGTTGTGCGTACAAAGCACACACGTAGACATTTCGTACTTTGGAAG	720
A3	GTGACTCTACGCTTCGGTTGTGCGTACAAAGCACACACGTAGACATTTCGTACTTTGGAAG	699
A1	GTGACTCTACGCTTCGGTTGTGCGTACAAAGCACACACGTAGACATTTCGTACTTTGGAAG	720
A2	GTGACTCTACGCTTCGGTTGTGCGTACAAAGCACACACGTAGACATTTCGTACTTTGGAAG	720
C1	GTGACTCTACGCTTCGGTTGTGCGTACAAAGCACACACGTAGACATCCGTACGTTGGAAG	720
D2	GTGACTCTACGCTTCGGTTGTGCGTACAAAGCACACACGTAGACATCCGTACGTTGGAAG	720
D3	GTGACTCTACGCTTCGGTTGTGCGTACAAAGCACACACGTAGACATCCGTACGTTGGAAG	720
D1	GTGACTCTACGCTTCGGTTGTGCGTACAAAGCACACACGTAGACATCCGTACGTTGGAAG	699
D4	GTGACTCTACGCTTCGGTTGTGCGTACAAAGCACACACGTAGACATCCGTACGTTGGAAG	699
C2	GTGACTCTACGCTTCGGTTGTGCGTACAAAGCACACACGTAGACATCCGTACGTTGGAAG	699
B4	GTGACTCTACGCTTCGGTTGTGCGTACAAAGCACACACGTAGACATCCGTACGTTGGAAG	699
B2	GTGACTCTACGCTTCGGTTGTGCGTACAAAGCACACACGTAGACATCCGTACGTTGGAAG	699
C4	GTGACTCTACGCTTCGGTTGTGCGTACAAAGCACACACGTAGACATCCGTACGTTGGAAG	699
B3	GTGACTCTACGCTTCGGTTGTGCGTACAAAGCACACACGTAGACATCCGTACGTTGGAAG	699
B1	GTGACTCTACGCTTCGGTTGTGCGTACAAAGCACACACGTAGACATCCGTACGTTGGAAG	720
C3	GTGACTCTACGCTTCGGTTGTGCGTACAAAGCACACACGTAGACATCCGTACGTTGGAAG	699

Sublineage	Nulceotide sequence E6/E7 HPV-16 bicistron	Position
A4	ACCTGTTAATGGGCACACTAGGAATTGTGTGCCCCATCTGTTCCAGAAACCATAA	776
A3	ACCTGTTAATGGGCACACTAGGAATTGTGTGCCCCATCTGTTCTCAGAAACCATAA	755
A1	ACCTGTTAATGGGCACACTAGGAATTGTGTGCCCCATCTGTTCTCAGAAACCATAA	776
A2	ACCTGTTAATGGGCACACTAGGAATTGTGTGCCCCATCTGTTCTCAGAAACCATAA	776
C1	ACCTGTTAATGGGCACACTAGGAATTGTGTGCCCCATCTGTTCTCAGAAACCATAA	776
D2	ACCTGTTAATGGGCACACTAGGAATTGTGTGCCCCATCTGTTCTCAGAAACCATAA	776
D3	ACCTGTTAATGGGCACACTAGGAATTGTGTGCCCCATCTGTTCTCAGAAACCATAA	776
D1	ACCTGTTAATGGGCACACTAGGAATTGTGTGCCCCATCTGTTCTCAGAAACCATAA	755
D4	ACCTGTTAATGGGCACACTAGGAATTGTGTGCCCCATCTGTTCTCAGAAACCATAA	755
C2	ACCTGTTAATGGGCACACTAGGAATTGTGTGCCCCATCTGTTCTCAGAAACCATAA	755
B4	ACCTGTTAATGGGCACACTAGGAATTGTGTGCCCCATCTGTTCTCAGAAACCATAA	755
B2	ACCTGTTAATGGGCACACTAGGAATTGTGTGCCCCATCTGTTCTCAGAAACCATAA	755
C4	ACCTGTTAATGGGCACACTAGGAATTGTGTGCCCCATCTGTTCTCAGAAACCATAA	755
B3	ACCTGTTAATGGGCACACTAGGAATTGTGTGCCCCATCTGTTCTCAGAAACCATAA	755
B1	ACCTGTTAATGGGCACACTAGGAATTGTGTGCCCCATCTGTTCTCAGAAACCATAA	776
C3	ACCTGTTAATGGGCACACTAGGAATTGTGTGCCCCATCTGTTCTCAGAAACCATAA	755

B) Nucleotide alignments of E6/E7 HPV-18 variants

Sublineage	Nulceotide sequence E6/E7 HPV-18 bicistron	Position
A3	ATGGCGCGCTTTGAGGATCCAACACGGCGACCCTACAAGCTACCTGATCTGTGCACGGAA	60
A5	ATGGCGCGCTTTGAGGATCCAACACGGCGACCCTACAAGCTACCGATCTGTGCACGGAA	60
A4	ATGGCGCGCTTTGAGGATCCAACACGGCGACCCTACAAGCTACCTGATCTGTGCACGGAA	60
A1	ATGGCGCGCTTTGAGGATCCAACACGGCGACCCTACAAGCTACCTGATCTGTGCACGGAA	60
A2	ATGGCGCGCTTTGAGGATCCAACACGGCGACCCTACAAGCTACCTGATCTGTGCACGGAA	60
B1	ATGGCGCGCTTTGAGGATCCAACACGGCGACCCTACAAGCTACCTGATCTGTGCACGGAA	60
C1	ATGGCGCGCTTTGAGGATCCAACACGGCGACCCTACAAGCTACCTGATCTGTGCACGGAA	60
B2	ATGGCGCGCTTTGAGGATCCAACACGGCGACCCTACAAGCTACCTGATCTGTGCACGGAA	60

B3 ATGGCGCGCTTTGAGGATCCAACACGGCGACCCCTACAAGCTACCTGATCTGTGCACGGAA 60

Sublineage	Nucleotide sequence E6/E7 HPV-18 bicistron	Position
A3	CTGAACACTTCACTGCAAGACATAGAAATAACCTGTGTATATTGCAAGACAGTATTGGAA	120
A5	CTGAACACTTCACTGCAAGACATAGAAATAACCTGTGTATATTGCAAGACAGTATTGGAA	120
A4	CTGAACACTTCACTGCAAGACATAGAAATAACCTGTGTATATTGCAAGACAGTATTGGAA	120
A1	CTGAACACTTCACTGCAAGACATAGAAATAACCTGTGTATATTGCAAGACAGTATTGGAA	120
A2	CTGAACACTTCACTGCAAGACATAGAAATAACCTGTGTATATTGCAAGACAGTATTGGAA	120
B1	CTGAACACTTCACTGCAAGACATAGAAATAACCTGTGTATATTGCAAGACAGTATTGGAA	120
C1	CTGAACACTTCACTGCAAGACATAGAAATAACCTGTGTATATTGCAAGACAGTATTGGAA	120
B2	CTGAACACTTCACTGCAAGACATAGAAATAACCTGTGTATATTGCAAGACAGTATTGGAA	120
B3	CTGAACACTTCACTGCAAGACATAGAAATAACCTGTGTATATTGCAAGACAGTATTGGAA	120

Sublineage	Nucleotide sequence E6/E7 HPV-18 bicistron	Position
A3	CTTACAGGGTATTTGAATTTGCATTTAAAGATTTATTTGTGGTGTATAGAGACAGTATA	180
A5	CTTACAGAGGTATTTGAATTTGCATTTAAAGATTTATTTGTGGTGTATAGAGACAGTATA	180
A4	CTTACAGAGGTATTTGAATTTGCATTTAAAGATTTATTTGTGGTGTATAGAGACAGTATA	180
A1	CTTACAGAGGTATTTGAATTTGCATTTAAAGATTTATTTGTGGTGTATAGAGACAGTATA	180
A2	CTTACAGAGGTATTTGAATTTGCATTTAAAGATTTATTTGTGGTGTATAGAGACAGTATA	180
B1	CTTACAGAGGTATTTGAATTTGCATTCAAAGATTTATTTGTAGTGTATAGAGACAGTATA	180
C1	CTTACAGAGGTATTTGAATTTGCATTCAAAGATTTATTTGTAGTGTATAGAGACAGTATA	180
B2	CTTACAGAGGTATTTGAATTTGCATTCAAAGATTTATTTGTAGTGTATAGAGACAGTATA	180
B3	CTTACAGAGGTATTTGAATTTGCATTCAAAGATTTATTTGTAGTGTATAGAGACAGTATA	180

Sublineage	Nucleotide sequence E6/E7 HPV-18 bicistron	Position
A3	CCGCATGCTGCATGCCATAAATGTATAGATTTTTATTCTAGAATTAGAGAATTAAGACAT	240
A5	CCGCATGCTGCATGCCATAAATGTATAGATTTTTATTCTAGAATTAGAGAATTAAGACAT	240
A4	CCGCATGCTGCATGCCATAAATGTATAGATTTTTATTCTAGAATTAGAGAATTAAGACAT	240
A1	CCGCATGCTGCATGCCATAAATGTATAGATTTTTATTCTAGAATTAGAGAATTAAGACAT	240
A2	CCGCATGCTGCATGCCATAAATGTATAGATTTTTATTCTAGAATTAGAGAATTAAGACAT	240
B1	CCGCATGCTGCATGCCATAAATGTATAGATTTCTATTCTAGAATTAGAGAATTAAGATAT	240
C1	CCGCATGCTGCATGCCATAAATGTATAGATTTTTATTCTAGAATTAGAGAATTAAGACAT	240
B2	CCGCATGCTGCATGCCATAAATGTATAGATTTTTATTCTAGAATTAGAGAATTAAGACAT	240
B3	CCGCATGCTGCATGCCATAAATGTATAGATTTTTATTCTAGAATTAGAGAATTAAGACAT	240

Sublineage	Nucleotide sequence E6/E7 HPV-18 bicistron	Position
A3	TATTCAGACTCTGTGTATGGAGACACATTGGAAAACTAACTAACACTGGGTTATACAAT	300
A5	TATTCAGACTCTGTGTATGGAGACACATTGGAGAACTAACTAACACTGGGTTATACAAT	300
A4	TATTCAGACTCTGTGTATGGAGACACATTGGAAAACTAACTAACACTGGGTTATACAAT	300
A1	TATTCAGACTCTGTGTATGGAGACACATTGGAAAACTAACTAACACTGGGTTATACAAT	300
A2	TATTCAGACTCTGTGTATGGAGACACATTGGAAAACTAACTAACACTGGGTTATACAAT	300
B1	TATTCAGACTCTGTGTATGGAGACACATTAGAAAACTAACTAACACTGGGTTATACAAT	300
C1	TATTCAGACTCTGTGTATGGAGACACATTAGAAAACTAACTAACACTGGGTTATACAAT	300
B2	TATTCAGACTCTGTGTATGGAGACACATTAGAAAACTAACTAACACTGGGTTATACAAT	300
B3	TATTCAGACTCTGTGTATGGAGACACATTAGAAAACTAACTAACACTGGGTTATACAAT	300

Sublineage	Nucleotide sequence E6/E7 HPV-18 bicistron	Position
A3	TTATTAATAAGGTGCCTGCGGTGCCAGAAACCGTTGAATCCAGCAGAAAACTTAGACAC	360
A5	TTATTAATAAGGTGCCTGCGGTGCCAGAAACCGTTGAATCCAGCAGAAAACTTAGACAC	360
A4	TTATTAATAAGGTGCCTGCGGTGCCAGAAACCGTTGAATCCAGCAGAAAACTTAGACAC	360

Sublineage	Nucleotide sequence E6/E7 HPV-18 bicistron	Position
A1	TTATTAATAAGGTGCCTGCGGTGCCAGAAACCGTTGAATCCAGCAGAAAACTTAGACAC	360
A2	TTATTAATAAGGTGCCTGCGGTGCCAGAAACCGTTGAATCCAGCAGAAAACTTAGACAC	360
B1	TTATTAATAAGGTGCCTGCGGTGCCAGAAACCGTTGAATCCAGCAGAAAACTTAGACAC	360
C1	TTATTAATAAGGTGCCTGCGGTGCCAGAAACCGTTGAATCCAGCAGAAAACTTAGACAC	360
B2	TTATTAATAAGGTGCCTGCGGTGCCAGAAACCGTTGAATCCAGCAGAAAACTTAGACAC	360
B3	TTATTAATAAGGTGCCTGCGGTGCCAGAAACCGTTGAATCCAGCAGAAAACTTAGACAC	360

Sublineage	Nucleotide sequence E6/E7 HPV-18 bicistron	Position
A3	CTTAATGAAAAACGACGATTCCACAACATAGCTGGGCACTATAGAGGCCAGTGCCATTTCG	420
A5	CTTAATGAAAAACGACGATTCCACAACATAGCTGGGCACTATAGAGGCCAGTGCCATTTCG	420
A4	CTTAATGAAAAACGACGATTCCACAACATAGCTGGGCACTATAGAGGCCAGTGCCATTTCG	420
A1	CTTAATGAAAAACGACGATTCCACAACATAGCTGGGCACTATAGAGGCCAGTGCCATTTCG	420
A2	CTTAATGAAAAACGACGATTCCACAACATAGCTGGGCACTATAGAGGCCAGTGCCATTTCG	420
B1	CTTAATGAAAAACGACGATTCCACAACATAGCTGGGCACTATAGAGGCCAGTGCCATTTCG	420
C1	CTTAATGAAAAACGACGATTCCACAACATAGCTGGGCACTATAGAGGCCAGTGCCATTTCG	420
B2	CTTAATGAAAAACGACGATTCCACAACATAGCTGGGCACTATAGAGGCCAGTGCCATTTCG	420
B3	CTTAATGAAAAACGACGATTCCACAACATAGCTGGGCACTATAGAGGCCAGTGCCATTTCG	420

Sublineage	Nucleotide sequence E6/E7 HPV-18 bicistron	Position
A3	TGCTGCAACCGAGCACGACAGGAAAGACTCCAACGACGCAGAGAAACACAAGTATAATAT	480
A5	TGCTGCAACCGAGCACGACAGGAAAGACTCCAACGACGCAGAGAAACACAAGTATAATAT	480
A4	TGCTGCAACCGAGCACGACAGGAAAGACTCCAACGACGCAGAGAAACACAAGTATAATAT	480
A1	TGCTGCAACCGAGCACGACAGGAAAGACTCCAACGACGCAGAGAAACACAAGTATAATAT	480
A2	TGCTGCAACCGAGCACGACAGGAAAGACTCCAACGACGCAGAGAAACACAAGTATAATAT	480
B1	TGCTGCAACCGAGCACGACAGGAAAGACTCCAACGACGCAGAGAAACACAAGTATAATAT	480
C1	TGCTGCAACCGAGCACGACAGGAAAGACTCCAACGACGCAGAGAAACACAAGTATAATAT	480
B2	TGCTGCAACCGAGCACGACAGGAAAGACTCCAACGACGCAGAGAAACACAAGTATAATAT	480
B3	TGCTGCAACCGAGCACGACAGGAAAGACTCCAACGACGCAGAGAAACACAAGTATAATAT	480

Sublineage	Nucleotide sequence E6/E7 HPV-18 bicistron	Position
A3	TAAGTATGCATGGACCTAAGGCAACATTGCAAGACATTGTATTGCATTTAGAGCCCCAAA	540
A5	TAAGTATGCATGGACCTAAGGCAACATTGCAAGACATTGTATTGCATTTAGAGCCCCAAA	540
A4	TAAGTATGCATGGACCTAAGGCAACATTGCAAGACATTGTATTGCATTTAGAGCCCCAAA	540
A1	TAAGTATGCATGGACCTAAGGCAACATTGCAAGACATTGTATTGCATTTAGAGCCCCAAA	540
A2	TAAGTATGCATGGACCTAAGGCAACATTGCAAGACATTGTATTGCATTTAGAGCCCCAAA	540
B1	TAAGTATGCATGGACCTAAGGCAACATTGCAAGACATTGTATTGCATTTAGAGCCCCAAA	540
C1	TAAGTATGCATGGACCTAAGGCAACATTGCAAGACATTGTATTGCATTTAGAGCCCCAAA	540
B2	TAAGTATGCATGGACCTAAGGCAACATTGCAAGACATTGTATTGCATTTAGAGCCCCAAA	540
B3	TAAGTATGCATGGACCTAAGGCAACATTGCAAGACATTGTATTGCATTTAGAGCCCCAAA	540

Sublineage	Nucleotide sequence E6/E7 HPV-18 bicistron	Position
A3	ATGAAATTCCGGTTGACCTTCTATGTCACGAGCAATTAAGCGACTCAGAGGAAGAAAACG	600
A5	ATGAAATTCCGGTTGACCTTCTATGTCACGAGCAATTAAGCGACTCAGAGGAAGAAAACG	600
A4	ATGAAATTCCGGTTGACCTTCTATGTCACGAGCAATTAAGCGACTCAGAGGAAGAAAACG	600
A1	ATGAAATTCCGGTTGACCTTCTATGTCACGAGCAATTAAGCGACTCAGAGGAAGAAAACG	600
A2	ATGAAATTCCGGTTGACCTTCTATGTCACGAGCAATTAAGCGACTCAGAGGAAGAAAACG	600
B1	ATGAAATTCCGGTTGACCTTCTATGTCACGAGCAATTAAGCGACTCAGAGGAAGAAAACG	600
C1	ATGAAATTCCGGTTGACCTTCTATGTCACGAGCAATTAAGCGACTCAGAGGAAGAAAACG	600
B2	ATGAAATTCCGGTTGACCTTCTATGTCACGAGCAATTAAGCGACTCAGAGGAAGAAAACG	600

B3 ATGAAATTCCGGTTGACCTTCTATGTCACGAGCAATTAAGCGACTCAGAGGAAGAAAACG 600

Sublineage	Nucleotide sequence E6/E7 HPV-18 bicistron	Position
A3	ATGAAATAGATGGAGTTAATCATCAACATTTACCAGCCCGACGAGCTGAACCACAACGTC	660
A5	ATGAAATAGATGGAGTTAATCATCAACATTTACCAGCCCGACGAGCCGAACCACAACGTC	660
A4	ATGAAATAGATGGAGTTAATCATCAACATTTACCAGCCCGACGAGCTGAACCACAACGTC	660
A1	ATGAAATAGATGGAGTTAATCATCAACATTTACCAGCCCGACGAGCCGAACCACAACGTC	660
A2	ATGAAATAGATGGAGTTAATCATCAACATTTACCAGCCCGACGAGCCGAACCACAACGTC	660
B1	ATGAAATAGATGGAGTTAATCATCAACATTTCCAGCCCGACGAGCCGAACCACAACGTC	660
C1	ATGAAATAGATGGAGTTAATCATCAACATTTACCAGCCCGACGAGCCGAACCACAACGTC	660
B2	ATGAAATAGATGGAGTTAATCATCAACATTTACCAGCCCGACGAGCCGAACCACAACGTC	660
B3	ATGAAATAGATGGAGTTAATCATCAACATTTACCAGCCCGACGAGCCGAACCACAACGTC	660

Sublineage	Nucleotide sequence E6/E7 HPV-18 bicistron	Position
A3	ACACAATGTTGTGTATGTGTTGTAAGTGTGAAGCCAGAATTGAGCTAGTAGTAGAAAGCT	720
A5	ACACAATGTTGTGTATGTGTTGTAAGTGTGAAGCCAGAATTGAGCTAGTAGTAGAAAGCT	720
A4	ACACAATGTTGTGTATGTGTTGTAAGTGTGAAGCCAGAATTGAGCTAGTAGTAGAAAGCT	720
A1	ACACAATGTTGTGTATGTGTTGTAAGTGTGAAGCCAGAATTGAGCTAGTAGTAGAAAGCT	720
A2	ACACAATGTTGTGTATGTGTTGTAAGTGTGAAGCCAGAATTGAGCTAGTAGTAGAAAGCT	720
B1	ACACAATGTTGTGTATGTGTTGTAAGTGTGAAGCCAGAATTGAGCTAGTAGTAGAAAGCT	720
C1	ACACAATGTTGTGTATGTGTTGTAAGTGTGAAGCCAGAATTGAGCTAGTAGTAGAAAGCT	720
B2	ACACAATGTTGTGTATGTGTTGTAAGTGTGAAGCCAGAATTGAGCTAGTAGTAGAAAGCT	720
B3	ACACAATGTTGTGTATGTGTTGTAAGTGTGAAGCCAGAATTGAGCTAGTAGTAGAAAGCT	720

Sublineage	Nucleotide sequence E6/E7 HPV-18 bicistron	Position
A3	CAGCAGACGACCTTCGAGCATTCCAGCAGCTGTTTCTGAACACCCTGTCCTTTGTGTGTC	780
A5	CAGCAGACGACCTTCGAGCATTCCAGCAGCTGTTTCTGAACACCCTGTCCTTTGTGTGTC	780
A4	CAGCAGACGACCTTCGAGCATTCCAGCAGCTGTTTCTGAACACCCTGTCCTTTGTGTGTC	780
A1	CAGCAGACGACCTTCGAGCATTCCAGCAGCTGTTTCTGAACACCCTGTCCTTTGTGTGTC	780
A2	CAGCAGACGACCTTCGAGCATTCCAGCAGCTGTTTCTGAACACCCTGTCCTTTGTGTGTC	780
B1	CAGCAGACGACCTTCGAGCATTCCAGCAGCTGTTTCTGACACCCTGTCCTTTGTGTGTC	780
C1	CAGCAGACGACCTTCGAGCATTCCAGCAGCTGTTTCTGAACACCCTGTCCTTTGTGTGTC	780
B2	CAGCAGACGACCTTCGAGCATTCCAGCAGCTGTTTCTGACACCCTGTCCTTTGTGTGTC	780
B3	CAGCAGACGACCTTCGAGCATTCCAGCAGCTGTTTCTGAACACCCTGTCCTTTGTGTGTC	780

Sublineage	Nucleotide sequence E6/E7 HPV-18 bicistron	Position
A3	CGTGGTGTGCATCCCAGCAGTAA	803
A5	CGTGGTGTGCATCCCAGCAGTAA	803
A4	CGTGGTGTGCATCCCAGCAGTAA	803
A1	CGTGGTGTGCATCCCAGCAGTAA	803
A2	CGTGGTGTGCATCCCAGCAGTAA	803
B1	CGTGGTGTGCATCCCAGCAGTAA	803
C1	CGTGGTGTGCATCCCAGCAGTAA	803
B2	CGTGGTGTGCATCCCAGCAGTAA	803
B3	CGTGGTGTGCATCCCAGCAGTAA	803

2. Amino acid changes among E6 and E7 variants of HR-HPV. HPV variants Sublineage were obtained from Papillomavirus Episteme (PaVE) portal [69], then NCBI accession number of each variant was used to analyzed both E6 and E7 proteins and then alignments were performed using Clustal Omega (v 1.2.4), **A) Variants of A) E6, B) E7** of HPV-16; and variants of **C) E6 and D) E7** of HPV-18 are shown. As depicted, E6 reference proteins are illustrated in pink, while in yellow E7 reference protein is shown. Moreover, amino acids changes of each variant are shown in green; and asterisk (*) represent similitudes in protein sequence among variants while empty spaces represent changes among variants in relation to reference protein. According to sequences obtained from NCBI, broken lines indicate differences in the start of translation among variants.

A) Amino acid alignments of E6 HPV-16 variants

Sublineage	Protein sequence of E6 HPV-16	Position
A2	MHQKRTAMFQDPQERPCKLPQLCTELQTTIHDIILECVYCKQQLLRREVDFAFRDLCIV	60
A3	-----MFQDPQERPRKLPQLCTELQTTIHDIILECVYCKQQLLRREVDFAFRDLCIV	53
A1	MHQKRTAMFQDPQERPRKLPQLCTELQTTIHDIILECVYCKQQLLRREVDFAFRDLCIV	60
A4	MHQKRTAMFQDPQERPRKLPQLCTELQTTIHDIILECVYCKQQLLRREVDFAFRDLCIV	60
D1	-----MFQDPQERPRKLPQLCTELQTTIHDIILECVYCKQQLLRREVDFAFRDLCIV	53
D2	MHQKRTAMFQDPQERPRKLPQLCTELQTTIHDIILECVYCKQQLLRREVDFAFRDLCIV	60
D3	MHQKRTAMFQDPQERPRKLPQLCTELQTTIHDIILECVYCKQQLLRREVDFAFRDLCIV	60
D4	-----MFQDPQERPRKLPQLCTELQTTIHDIILECVYCKQQLLRREVDFAFRDLCIV	53
C2	-----MFQDPQERPRKIPDLCTELQTTIHDIILECVYCKQQLLRREVDFAFRDLCIV	53
B4	-----MFQDPQERPCKLPDLCTELQTTIHDIILECVYCKQQLLRREVDFAFRDLCIV	53
B3	-----MFQDPQERPRKLPDLCTELQTTIHDIILECVYCKQQLLRREVDFAFRDLCIV	53
B1	MHQKRTAMFQDPQERPCKLPDLCTELQTTIHDIILECVYCKQQLLRREVDFAFRDLCIV	60
C1	MHQKRTAMFQDPQERPCKLPDLCTELQTTIHDIILECVYCKQQLLRREVDFAFRDLCIV	60
B2	-----MFQDPQERPCKLPDLCTELQTTIHDIILECVYCKQQLLRREVDFAFRDLCIV	53
C3	-----MFQDPQERPRKLPDLCTELQTTIHDIILECVYCKQQLLRREVDFAFRDLCIV	53
C4	-----MFQDPQERPRKLPDLCTELQTTIHDIILECVYCKQQLLRREVDFAFRDLCIV	53
	***** *.*.*****:*****:*****	

Sublineage	Protein sequence of E6 HPV-16	Position
A2	YRDGNPYAVCDKCLKFYISKISEYRHVCYSVYGTTLQYQYNKPLCDLLIRCINCQKPLCPE	120
A3	YRDGSPYAVCDKCLKFYISKISEYRHVCYSVYGTTLQYQYNKPLCDLLIRCINCQKPLCPE	113
A1	YRDGNPYAVCDKCLKFYISKISEYRHVCYSVYGTTLQYQYNKPLCDLLIRCINCQKPLCPE	120
A4	YRDGNPYAVCDKCLKFYISKISEYRHVCYSVYGTTLQYQYNKPLCDLLIRCINCQKPLCPE	120
D1	YRDGNPYAVCDKCLKFYISKISEYRHVCYSVYGTTLQYQYNKPLCDLLIRCINCQKPLCPE	113
D2	YRDGNPYAVCDKCLKFYISKISEYRHVCYSVYGTTLQYQYNKPLCDLLIRCINCQKPLCPE	120
D3	YRDGNPYAVCDKCLKFYISKISEYRHVCYSVYGTTLQYQYNKPLCDLLIRCINCQKPLCPE	120
D4	YRDGNPYAVCDKCLKFYISKISEYRHVCYSVYGTTLQYQYNKPLCDLLIRCINCQKPLCPE	113
C2	YRDGNPYAVCDKCLKFYISKISEYRHVCYSVYGTTLQYQYNKPLCDLLIRCINCQKPLCPE	113
B4	YRDGNPYAVCDKCLKFYISKISEYRHVCYSVYGTTLQYQYNKPLCDLLIRCINCQKPLCPE	113
B3	YRDGNPYAVCDKCLKFYISKISEYRHVCYSVYGTTLQYQYNKPLCDLLIRCINCQKPLCPE	113
B1	YRDGNPYAVCDKCLKFYISKISEYRHVCYSVYGTTLQYQYNKPLCDLLIRCINCQKPLCPE	120
C1	YRDGNPYAVCDKCLKFYISKISEYRHVCYSVYGTTLQYQYNKPLCDLLIRCINCQKPLCPE	120
B2	YRDGNPYAVCDKCLKFYISKISEYRHVCYSVYGTTLQYQYNKPLCDLLIRCINCQKPLCPE	113
C3	YRDGNPYAVCDKCLKFYISKISEYRHVCYSVYGTTLQYQYNKPLCDLLIRCINCQKPLCPE	113
C4	YRDGNPYAVCDKCLKFYISKISEYRHVCYSVYGTTLQYQYNKPLCDLLIRCINCQKPLCPE	113
	****.*.*.*:*****:*****:*****	

Sublineage	Protein sequence of E6 HPV-16	Position
A2	EKQRHLDKKQRFHNIIRGRWTGRCMSSCRSSRTTRETQL	158
A3	EKQRHLDKKQRFHNIIRGRWTGRCMSSCRSSRTTRETQL	151
A1	EKQRHLDKKQRFHNIIRGRWTGRCMSSCRSSRTTRETQL	158

A4	EKQRHLDDKKQRFHNIRGRWTGRCMSSCRSSRTRRETQL	158
D1	EKQRHLDDKKQRFHNIRGRWTGRCMSSCRSSRTRRETQL	151
D2	EKQRHLDDKKQRFHNIRGRWTGRCMSSCRSSRTRRETQL	158
D3	EKQRHLDDKKQRFHNIRGRWTGRCMSSCRSSRTRRETQL	158
D4	EKQRHLDDKKQRFHNIRGRWTGRCMSSCRSSRTRRETQL	151
C2	EKQRHLDDKKQRFHNIRGRWTGRCMSSCRSSRTRRETQL	151
B4	EKQRHLDDKKQRFHNIRGRWTGRCMSSCRSSRTRRETQL	151
B3	EKQRHLDDKKQRFHNIRGRWTGRCMSSCRSSRTRRETQL	151
B1	EKQRHLDDKKQRFHNIRGRWTGRCMSSCRSSRTRRETQL	158
C1	EKQRHLDDKKQRFHNIRGRWTGRCMSSCRSSRTRRETQL	158
B2	EKQRHLDDKKQRFHNIRGRWTGRCMSSCRSSRTRRETQL	151
C3	EKQRHLDDKKQRFHNIRGRWTGRCMSSCRSSRTRRETQL	151
C4	EKQRHLDDKKQRFHNIRGRWTGRCMSSCRSSRTRRETQL	151

B) Amino acid alignments of E7 HPV-16 variants

Sublineage	Protein sequence of E7 HPV-16	Position
C4	MHGDTPTLHEYMLDLQPETTDLYCYEQLNDSSEEEDEIDGPAGQAEPDRAHYNIVTFCK	60
A1	MHGDTPTLHEYMLDLQPETTDLYCYEQLNDSSEEEDEIDGPAGQAEPDRAHYNIVTFCK	60
A2	MHGDTPTLHEYMLDLQPETTDLYCYEQLNDSSEEEDEIDGPAGQAEPDRAHYNIVTFCK	60
A3	MHGDTPTLHEYMLDLQPETTDLYCYEQLNDSSEEEDEIDGPAGQAEPDRAHYNIVTFCK	60
B1	MHGDTPTLHEYMLDLQPETTDLYCYEQLNDSSEEEDEIDGPAGQAEPDRAHYNIVTFCK	60
B3	MHGDTPTLHEYMLDLQPETTDLYCYEQLNDSSEEEDEIDGPAGQAEPDRAHYNIVTFCK	60
B4	MHGDTPTLHEYMLDLQPETTDLYCYEQLNDSSEEEDEIDGPAGQAEPDRAHYNIVTFCK	60
C2	MHGDTPTLHEYMLDLQPETTDLYCYEQLNDSSEEEDEIDGPAGQAEPDRAHYNIVTFCK	60
C3	MHGDTPTLHEYMLDLQPETTDLYCYEQLNDSSEEEDEIDGPAGQAEPDRAHYNIVTFCK	60
D1	MHGDTPTLHEYMLDLQPETTDLYCYEQLNDSSEEEDEIDGPAGQAEPDRAHYNIVTFCK	60
D2	MHGDTPTLHEYMLDLQPETTDLYCYEQLNDSSEEEDEIDGPAGQAEPDRAHYNIVTFCK	60
D3	MHGDTPTLHEYMLDLQPETTDLYCYEQLNDSSEEEDEIDGPAGQAEPDRAHYNIVTFCK	60
D4	MHGDTPTLHEYMLDLQPETTDLYCYEQLNDSSEEEDEIDGPAGQAEPDRAHYNIVTFCK	60
A4	MHGDTPTLHEYMLDLQPETTDLYCYEQLSDSSEEEDEIDGPAGQAEPDRAHYNIVTFCK	60
B2	MHGDTPTLHEYMLDLQPETTDLYCYEQLSDSSEEEDEIDGPAGQAEPDRAHYNIVTFCK	60
C1	MHGDTPTLHEYMLDLQPETTDLYCYEQLSDSSEEEDEIDGPAGQAEPDRAHYNIVTFCK	60

Sublineage	Protein sequence of E7 HPV-16	Position
C4	CDSTLRRCVQSTHVDIRTLEDLLMGTLGIVCPICSQKP	98
A1	CDSTLRRCVQSTHVDIRTLEDLLMGTLGIVCPICSQKP	98
A2	CDSTLRRCVQSTHVDIRTLEDLLMGTLGIVCPICSQKP	98
A3	CDSTLRRCVQSTHVDIRTLEDLLMGTLGIVCPICSQKP	98
B1	CDSTLRRCVQSTHVDIRTLEDLLMGTLGIVCPICSQKP	98
B3	CDSTLRRCVQSTHVDIRTLEDLLMGTLGIVCPICSQKP	98
B4	CDSTLRRCVQSTHVDIRTLEDLLMGTLGIVCPICSQKP	98
C2	CDSTLRRCVQSTHVDIRTLEDLLMGTLGIVCPICSQKP	98
C3	CDSTLRRCVQSTHVDIRTLEDLLMGTLGIVCPICSQKP	98
D1	CDSTLRRCVQSTHVDIRTLEDLLMGTLGIVCPICSQKP	98
D2	CDSTLRRCVQSTHVDIRTLEDLLMGTLGIVCPICSQKP	98
D3	CDSTLRRCVQSTHVDIRTLEDLLMGTLGIVCPICSQKP	98
D4	CDSTLRRCVQSTHVDIRTLEDLLMGTLGIVCPICSQKP	98
A4	CDSTLRRCVQSTHVDIRTLEDLLMGTLGIVCPICSQKP	98
B2	CDSTLRRCVQSTHVDIRTLEDLLMGTLGIVCPICSQKP	98
C1	CDSTLRRCVQSTHVDIRTLEDLLMGTLGIVCPICSQKP	98

C) Amino acid alignments of E6 HPV-18 variants

Sublineage	Protein sequence of E6 HPV-18	Position
A1	MARFEDPTRRPYKLPDLCTELNTSLQDIEITCVYCKTVLELLEVFEEFAFKDLFVVYRDSI	60
A2	MARFEDPTRRPYKLPDLCTELNTSLQDIEITCVYCKTVLELLEVFEEFAFKDLFVVYRDSI	60
A4	MARFEDPTRRPYKLPDLCTELNTSLQDIEITCVYCKTVLELLEVFEEFAFKDLFVVYRDSI	60
A5	MARFEDPTRRPYKLPDLCTELNTSLQDIEITCVYCKTVLELLEVFEEFAFKDLFVVYRDSI	60
C1	MARFEDPTRRPYKLPDLCTELNTSLQDIEITCVYCKTVLELLEVFEEFAFKDLFVVYRDSI	60
A3	MARFEDPTRRPYKLPDLCTELNTSLQDIEITCVYCKTVLELTGVFEEFAFKDLFVVYRDSI	60
B1	MARFEDPTRRPYKLPDLCTELNTSLQDIEITCVYCKTVLELLEVFEEFAFKDLFVVYRDSI	60
B2	MARFEDPTRRPYKLPDLCTELNTSLQDIEITCVYCKTVLELLEVFEEFAFKDLFVVYRDSI	60
B3	MARFEDPTRRPYKLPDLCTELNTSLQDIEITCVYCKTVLELLEVFEEFAFKDLFVVYRDSI	60
***** : *****		

Sublineage	Protein sequence of E6 HPV-18	Position
A1	PHAACHKCIDFYSRIRELRHYSDSVYGDITLEKLTNTGLYNLLIRCLRCQKPLNPAEKL RH	120
A2	PHAACHKCIDFYSRIRELRHYSDSVYGDITLEKLTNTGLYNLLIRCLRCQKPLNPAEKL RH	120
A4	PHAACHKCIDFYSRIRELRHYSDSVYGDITLEKLTNTGLYNLLIRCLRCQKPLNPAEKL RH	120
A5	PHAACHKCIDFYSRIRELRHYSDSVYGDITLEKLTNTGLYNLLIRCLRCQKPLNPAEKL RH	120
C1	PHAACHKCIDFYSRIRELRHYSDSVYGDITLEKLTNTGLYNLLIRCLRCQKPLNPAEKL RH	120
A3	PHAACHKCIDFYSRIRELRHYSDSVYGDITLEKLTNTGLYNLLIRCLRCQKPLNPAEKL RH	120
B1	PHAACHKCIDFYSRIRELRHYSDSVYGDITLEKLTNTGLYNLLIRCLRCQKPLNPAEKL RH	120
B2	PHAACHKCIDFYSRIRELRHYSDSVYGDITLEKLTNTGLYNLLIRCLRCQKPLNPAEKL RH	120
B3	PHAACHKCIDFYSRIRELRHYSDSVYGDITLEKLTNTGLYNLLIRCLRCQKPLNPAEKL RH	120
***** : *****		

Sublineage	Protein sequence of E6 HPV-18	Position
A1	LNEKRRFHNIAGHYRGQCHSCCNRARQERLQRRRETQV	158
A2	LNEKRRFHNIAGHYRGQCHSCCNRARQERLQRRRETQV	158
A4	LNEKRRFHNIAGHYRGQCHSCCNRARQERLQRRRETQV	158
A5	LNEKRRFHNIAGHYRGQCHSCCNRARQERLQRRRETQV	158
C1	LNEKRRFHNIAGHYRGQCHSCCNRARQERLQRRRETQV	158
A3	LNEKRRFHNIAGHYRGQCHSCCNRARQERLQRRRETQV	158
B1	LNEKRRFHNIAGHYRGQCHSCCNRARQERLQRRRETQV	158
B2	LNEKRRFHNIAGHYRGQCHSCCNRARQERLQRRRETQV	158
B3	LNEKRRFHNIAGHYRGQCHSCCNRARQERLQRRRETQV	158
***** : *****		

D) Amino acid alignments of E7 HPV-18 variants

Sublineage	Protein sequence of E6 HPV-18	Position
A1	MHGPKATLQDIVLHLEPQNEIPVDLLCHEQLSDSEEENDEIDGVNHQHLPARRAEPQRHT	60
A2	MHGPKATLQDIVLHLEPQNEIPVDLLCHEQLSDSEEENDEIDGVNHQHLPARRAEPQRHT	60
A3	MHGPKATLQDIVLHLEPQNEIPVDLLCHEQLSDSEEENDEIDGVNHQHLPARRAEPQRHT	60
A4	MHGPKATLQDIVLHLEPQNEIPVDLLCHEQLSDSEEENDEIDGVNHQHLPARRAEPQRHT	60
A5	MHGPKATLQDIVLHLEPQNEIPVDLLCHEQLSDSEEENDEIDGVNHQHLPARRAEPQRHT	60
C1	MYGPKATLQDIVLHLEPQNEIPVDLLCHEQLSDSEEENDEIDGVNHQHLPARRAEPQRHT	60
B3	MYGPKATLQDIVLHLEPQNEIPVDLLCHEQLSDSEEENDEIDGVNHQHLPARRAEPQRHT	60
B1	MYGPKATLQDIVLHLEPQNEIPVDLLCHEQLSDSEEENDEIDGVNHQHLPARRAEPQRHT	60
B2	MYGPKATLQDIVLHLEPQNDIPVDLLCHEQLSDSEEENDEIDGVNHQHLPARRAEPQRHT	60
* : ***** : *****		

Sublineage	Protein sequence of E6 HPV-18	Position
A1	MLCMCKCEARIELVVESSADDLRAFQQLFLNTLSFVCPWCASQQ	105
A2	MLCMCKCEARIELVVESSADDLRAFQQLFLNTLSFVCPWCASQQ	105
A3	MLCMCKCEARIELVVESSADDLRAFQQLFLNTLSFVCPWCASQQ	105
A4	MLCMCKCEARIELVVESSADDLRAFQQLFLNTLSFVCPWCASQQ	105
A5	MLCMCKCEARIELVVESSADDLRAFQQLFLNTLSFVCPWCASQQ	105
C1	MLCMCKCEARIELVVESSADDLRAFQQLFLNTLSFVCPWCASQQ	105
B3	MLCMCKCEARIELVVESSADDLRAFQQLFLNTLSFVCPWCASQQ	105
B1	MLCMCKCEARIELVVESSADDLRAFQQLFLNTLSFVCPWCASQQ	105
B2	MLCMCKCEARIELVVESSADDLRAFQQLFLNTLSFVCPWCASQQ	105
	*****.*****	

3. NCBI accession number of each HPV-16 and -18 variants that were used for alignments according to Papillomavirus Episteme (PaVE) portal [69].

HPV-16 SUBLINEAGES	NCBI ACCESSION NUMBER
A1	NC_001526
A2	AF536179
A3	HQ644236
A4	AF534061
B1	AF536180
B2	HQ644298
B3	KU053910
B4	KU053914
C1	AF472509
C2	HQ644244
C3	KU053921
C4	KU053922
D1	HQ644257
D2	AY686579
D3	AF402678
D4	KU053933

HPV-18 SUBLINEAGES	NCBI ACCESSION NUMBER
A1	AY262282
A2	EF202146
A3	EF202147
A4	EF202151
A5	GQ180787
B1	EF202155
B2	KC470225
B3	EF202152
C1	KC470229