Introduction

Papanicolaou (Pap) smear samples have been shown to detect cervical cancer even without a minor surgical procedure. This was first demonstrated by Traut et al. (1) 1943. Cytological findings were originally classified into 5 groups by Papanicolaou et al. (2) in 1963 (Table 1).

Different classification systems for Pap smear samples have been internationally used (3). Germany applies the Munich nomenclature for Pap smear evaluation. The Munich nomenclature was established in 1975 as a modification of Papanicolaou’s classification. This modification was necessary to meet the international requirements of a descriptive classification (4). In 1990, the Munich nomenclature was updated by the creation of Munich II. The revision of Munich II in 2013 led to the Munich III nomenclature in July 2014. Since January 1 2015, Munich III has been established as the only system officially used in Germany.

With Munich III, new subgroups were created to categorize different grades of dysplasia. Unclear findings that are neither clearly reactive nor meet certain criteria of dysplasia are now marked. Munich III further differentiates between squamous, epithelial, and glandular cells (5).

Furthermore, the Munich III system is attempting to make cytological findings transferrable to the internationally more commonly used The Bethesda System. This offers the opportunity to compare them with international studies (Table 2).

Material and Methods

Method comparison was done by analyzing 117 Pap smear samples in the cytological laboratory at the department of Obstetrics and Gynecology of Luebeck University between January and March 2014. All Pap smear samples were evaluated twice using both nomenclatures (Munich II and Munich III).
### Table 2. Comparison of classifications Munich II, Munich III, and The Bethesda System (modified after Griesser et al. (5), 2013)

<table>
<thead>
<tr>
<th>Munich II Nomenclature</th>
<th>Munich III Nomenclature</th>
<th>The Bethesda System</th>
</tr>
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<tbody>
<tr>
<td>I Normal cell pattern</td>
<td>0 Unsatisfactory specimen → repeat Pap smear</td>
<td>Unsatisfactory for evaluation</td>
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<td></td>
<td>I Normal or unsuspicious cell pattern → Pap smear next routine checkup</td>
<td>NILM</td>
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<tr>
<td></td>
<td>IIa Normal cell pattern with suspicious patient history → consider control Pap smear due to suspicious patient history (cytologic/histologic/colposcopic/clinical findings)</td>
<td>NILM</td>
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<td></td>
<td>II Mild inflammatory, regenerative, metaplastic, or degenerative changes II-p Squamous epithelium with low-grade changes of the nucleus; less than CIN 1, also with collycystic cytoplasm/paraceratotic changes → if applicable, control Pap smear considering patient history and clinical findings (possibly after inflammation treatment and/or hormonal treatment; in special cases additional diagnostic methods and/or colposcopy)</td>
<td>ASC-US</td>
</tr>
<tr>
<td></td>
<td>II-g Abnormal cervical glandular cells; more than reactive changes → consider control Pap smear depending on patient history and clinical findings (possibly after inflammation treatment, in special cases additional methods and/or colposcopy)</td>
<td>AGC endocervical NOS</td>
</tr>
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<td></td>
<td>II-e Endometrial cells; women &gt;40 y.o. and second half of the cycle → clinical checkup considering patient history and clinical findings</td>
<td>Endometrial cells</td>
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<td>III Unclear findings: severely inflammatory or degenerative and/or poorly preserved cell material; abnormal glandular or stromal cells; dysplasia, carcinoma in situ, or invasive carcinoma not excluded III-p CIN 2/CIN 3/squamous cell carcinoma cannot be excluded → colposcopy, if applicable additional diagnostic methods, possibly short-term re-Pap smear after inflammatory treatment and/or hormonal treatment</td>
<td>ASC-H</td>
</tr>
<tr>
<td></td>
<td>III-g Distinctive atypia of glandular cells, adenocarcinoma in situ/invasive adenocarcinoma cannot be excluded → colposcopy, if applicable additional diagnostic methods</td>
<td>AGC endocervical favor neoplastic</td>
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<tr>
<td></td>
<td>III-e Abnormal endometrial cells → further clinical diagnostics, if applicable with histological support</td>
<td>AGC endometrial</td>
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<tr>
<td></td>
<td>III-x Unclear glandular cells of unknown origin → further diagnostics (e.g. diagnostic curettage; if applicable additional diagnostic methods/colposcopy)</td>
<td>AGC favor neoplastic</td>
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<tr>
<td>IIID Cells of mild or moderate dysplasia</td>
<td>IIID Dysplastic findings with greater tendency of regression</td>
<td>LSIL</td>
</tr>
<tr>
<td></td>
<td>IIID 1 Cells of mild dysplasia (CIN 1) → control Pap smear in 6 months, if persisting for &gt;12 months; colposcopy, if applicable additional diagnostic methods</td>
<td>LSIL</td>
</tr>
</tbody>
</table>
analyzed at our cytological laboratory during this time period. No exclusion criteria were in use. All patient samples were evaluated twice by certified cytologists using the Munich II and Munich III nomenclatures. Informed patient consent and ethical approval (#12-234 Luebeck University) was obtained. Statistical analysis was performed with SPSS Statistics Version 22 (IBM Corporation; Armonk, USA).

Results

The classification of Pap I significantly differs in Munich II and III (p<0.001). Results are presented in table 3. While 0 of the 117 analyzed samples were classified as Pap I (“normal cell pattern”) in Munich II, 55 were categorized as Pap I (“normal or unsuspicious cell pattern”) in Munich III.

New subcategories in categories II and III of Munich III allow a more specific classification of Pap smear samples. Pap II findings were less frequently seen in Munich III (47% vs 94%, p< 0.001). Pap smear samples categorized in group III as “unclear findings” of the Munich nomenclatures stayed almost the same in both systems. One Pap smear sample showed the loss of cellular material. In Munich III, this Pap smear sample is now linked to the category 0 “unsatisfactory for evaluation.” In Munich II, it has been classified in category III as an “unclear finding.”

IIID Pap smear samples are subcategorized in Munich III in mild dysplasia (IIID 1) and moderate dysplasia (IIID 2).

The Pap smear samples classified as Pap IVa and Pap V in Munich II were classified as Pap IVa-p and Pap V-p due to the squamous cell origin.

Discussion

Many different cytology classification systems exist worldwide. European guidelines highly recommend that different systems should be transferrable into the internationally accepted and used The Bethesda System (3, 6). The German system, the Munich nomenclature, was created on the basis of the numerical Papanicolaou classification system for Pap smear samples (2). Pap smear evaluation and categorization are important for cervical cancer checkup. The incidences of cervical cancer have been reduced due to Pap smear examinations (5). Non-participation in cervical cancer screening is the most significant cause for persistent cervical cancer (7).

A detailed and exact classification system is essential to take necessary actions needed for treating cytological findings. The new group 0 in Munich III clearly marks Pap smear samples unsatisfactory for evaluation and clears the former group III in Munich II. Pap smear findings with a benign background and findings that do not imply an increased risk of neoplasia...
(the Bethesda category “negative for intraepithelial lesions or malignancy” NILM) are now classified as Pap I. These findings include hormonal patterns, repair changes, microglandular hyperplasia, tubo-endometrioid metaplasia, tubal metaplasia, irradiation changes, alterations resulting from inflammation, or the presence of an intrauterine contraceptive device (8). These normal or unsuspicious cell patterns are classified as Pap I in Munich III. These findings were formerly classified as Pap II. Pap II is now reserved for findings of low protective value.

Pap III still marks unclear findings, but categorizes in the same way as the new Pap IV and V on histological characteristics now. These normal or unsuspicious cell patterns are classified as Pap I in Munich III. These findings were formerly classified as Pap II. Pap II is now reserved for findings of low protective value.

Pap III still marks unclear findings, but categorizes in the same way as the new Pap IV and V on histological characteristics now. This means that cells of squamous (-p), glandular (-g), or endometrial (-e) origin are clearly made visible with their suffixes. Cells of unknown origin get suffixed with “-x”.

The Munich II system was criticized to link moderate with mild dysplasia (8, 9). In Munich III, Pap IIID is now subcategorized in IIID 1 [cervical intraepithelial neoplasia grade 1 (CIN 1)] and IIID 2 (CIN 2). Also, compared to The Bethesda System, Munich III differentiates between moderate- and high-grade dysplasia. CIN 2 is possibly remissible, which means that depending on colposcopic findings, surgery can be avoided (10). This fact made the new group IIID 2 necessary.

A limitation of our study is that we only investigated 117 Pap smear samples. The single-center design is another limitation. However, we still demonstrated with our study results the differences of the nomenclatures Munich II and III. The former clusters of Munich II have been extended by distinctly defined subgroups, resulting in a more precise way to differentiate cytological findings. Munich III clearly separates patients at risk from those with no evidence of pathology by the new definition of Pap I and II. In our case, 55 patients (47% of all Pap smear samples) now categorized as Pap I (normal or unsuspicious) in Munich III will receive the next Pap smear in the regular routine checkup interval. The same patients in Munich II (Pap II) had no statement concerning the unsuspicious presentation of the cervical smear. Due to the restrictive use of Pap II and the more precisely defined Pap III, the new nomenclature Munich III improves the positive predictive value (11).

### Ethics Committee Approval:
Ethics committee approval was received for this study from the ethics committee of Luebeck University (#12-234).

### Informed Consent:
Written informed consent was obtained from patients who participated in this study.

### Peer-review:
Externally peer-reviewed.

### Author Contributions:
Concept - C.C., C.B., D.B.; Design - C.C., C.B., D.B.; Supervision - D.B.; Materials - D.B.; Data Collection and/or Processing - D.B.; Analysis and/or Interpretation - C.C., C.B., D.B.; Literature Search - C.C.; Writing - C.C., C.B.; Critical Reviews - C.C.

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### Conflict of Interest:
No conflict of interest was declared by the authors.

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