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# Evaluation Tools for Assessing Autonomy of Surgical Residents in the Operating Room and Factors Influencing Access to Autonomy: A Systematic Literature Review

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**BACKGROUND:** Surgical residents in France lack a clear pedagogical framework for achieving autonomy in the operating room. The progressive acquisition of surgical autonomy is a determining factor in the confidence of operators for their future independent practice. Currently, there is no autonomy scale commonly used in Europe. The objective of this study is to identify existing tools for quantifying the autonomy of residents and the factors that influence it.

**MATERIALS AND METHODS:** We conducted a qualitative systematic review following the recommendations of the Systematic Review Without Meta-Analysis (SWiM) guidelines. Publications were extracted from the MEDLINE (PubMed), EMBASE, and PSYCINFO databases. All publications without date restrictions up to July 2022 were identified. Results: Among the 231 identified publications, 21 met the inclusion criteria. Seventeen publications used a graded autonomy assessment tool by the student and/or the teacher, while 4 used evaluations by an observing third party. We found 8 different autonomy scales, with the Zwisch Scale representing 57.1% of the cases. Factors influencing autonomy were diverse, including the work context, experience, and gender of the resident and their teacher.

**DISCUSSION:** We found heterogeneity in the tools used to "measure" the autonomy of a resident in the operating room. The SIMPL tool or the Zwisch Scale appear to be the most frequently used tools. The relationship

between autonomy, performance, confidence, and knowledge may require multidimensional tools that encompass various areas of competence, but this could make their daily application more challenging. The factors influencing autonomy are numerous; and understanding them would improve teaching in the operating room. There is a significant lack of data on surgical autonomy in France, as well as a lack of evaluation in the field of gynecology-obstetrics worldwide. (J Surg Ed 81:182–192. © 2023 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

**KEY WORDS:** operative autonomy, resident, SIMPL app, surgical education, Zwisch scale

**COMPETENCIES:** Medical Knowledge, Professionalism, Interpersonal and Communication Skills, Practice-Based Learning and Improvement

## INTRODUCTION

In the era of the new residency reform in France, the progressive and adapted acquisition of autonomy during the residency requires a clear pedagogical framework. To date, there are no recommendations regarding the number of surgical procedures that should be performed autonomously or standardized practical evaluations to be completed before the end of residency. Standardized educational pathways exist, particularly in the United States, and creating a European equivalent may present numerous challenges in establishing a fair system.

The autonomy granted to a resident in the operating room is a significant part of their technical training and sometimes reflects their confidence in their future practice.<sup>1</sup> Several studies conducted in France have indicated dissatisfaction among surgical residents regarding their surgical training. Only 57% of gynecology-obstetrics residents with a surgical orientation considered their training to be "at least adequate."<sup>2</sup>

Defining the autonomy of a resident in the operating room is complex, and its qualitative and quantitative evaluation is even more so. There is a real need to measure this autonomy to identify the factors influencing its attainment during residency. Furthermore, very few publications specifically address gynecology-obstetrics. In order to explore potential tailored training approaches for future surgeons, we conducted a literature review on methods for evaluating autonomy in the operating room and the factors that influence it.

## MATERIALS AND METHODS

Given the heterogeneity of study models and reported results, we conducted a qualitative systematic review following the recommendations of the Systematic Review Without Meta-Analysis (SWiM) guidelines.<sup>3</sup> Two authors conducted the search (AS and VD). In July 2022, a search was conducted using the MEDLINE (PubMed), EMBASE, and PSYCINFO databases. All published studies in French and English, without any restrictions on publication date, were included. The following keywords were used in the search: 'autonomy resident gynecology' OR ([autonomy'/exp OR autonomy] AND ['resident'/exp OR resident] AND ['gynecology'/exp OR gynecology]) and ([autonomy'/exp OR autonomy] AND factors AND ['resident'/exp OR resident] AND ['surgery'/exp OR surgery]). Only original studies were included, while literature reviews were excluded. Studies that did not evaluate autonomy or the confidence granted to a resident during a surgical procedure were also excluded. Since the majority of studies were conducted on cohorts from various surgical specialties (excluding gynecology), we focused on all surgical specialties and not only those related to gynecology-obstetrics.

Data extraction was performed by 2 authors (A.S. and V.D.). General information from the included articles, including the title, authors, primary objective, sample size, and study type, was extracted. With regard to the subject of our review, the following were extracted: study population (specialty of the surgical resident) and practice location, study type, autonomy assessment method, factors influencing autonomy and observed differences.

## RESULTS

The application of SWiM recommendations for the flow chart is presented in [Figure 1](#). The search strategy yielded 231 publications, of which 184 were retained after removing duplicates. Among these, 114 studies were excluded after reading the titles and/or abstracts. Finally, we included 39 articles for this literature review after reading the full text. We chose to focus our final analysis on prospective and retrospective observational studies, excluding surveys and qualitative studies, resulting in a total of 21 included studies.

The included publications in our search consisted of 18 publications based on retrospective cohorts (85.7%) and 3 prospective studies. The cohort sizes varied greatly but were nevertheless significant, ranging from 67<sup>4</sup> to 119,380<sup>5</sup> surgical cases assessed.

The population characteristics of the evaluated residents in these studies are presented in [Table 1](#). The majority of studies involved only general surgery residents (57.1%), which corresponds to visceral surgery in France. Most studies were conducted in the United States. Two studies were conducted in New Zealand, and 1 in Kenya. The majority of the studies included residents at all stages of training to account for the obvious link between autonomy and seniority. One publication evaluated the validity of an autonomy measurement tool solely at the end of residency.<sup>6</sup> No prospective or retrospective observational studies specifically focused on gynecology-obstetrics residents.

## TOOLS FOR ASSESSING AUTONOMY

In addition to qualitative research methods based on interviews and questionnaires addressed to students and their teachers, retrospective and prospective studies require tools for quantitatively measuring the autonomy granted to a resident during a surgical procedure. The different tools found in the publications are summarized in [Table 2](#). There were no official French translations of these scales or tools.

### Zwisch Scale

In 60% of the included publications, autonomy was assessed using the Zwisch Scale (ZS). This is a validated tool for grading the autonomy of a resident during a surgical procedure.<sup>7</sup> The surgeon and/or the resident evaluate the autonomy granted to the resident on a scale ranging from 1 to 4, which includes "Show and explain," "Active assistance," "Passive assistance," and "Supervision only." Autonomy is assessed postoperatively, and Residents and Surgeons must rate the autonomy granted during more than half of the critical part of the surgery.

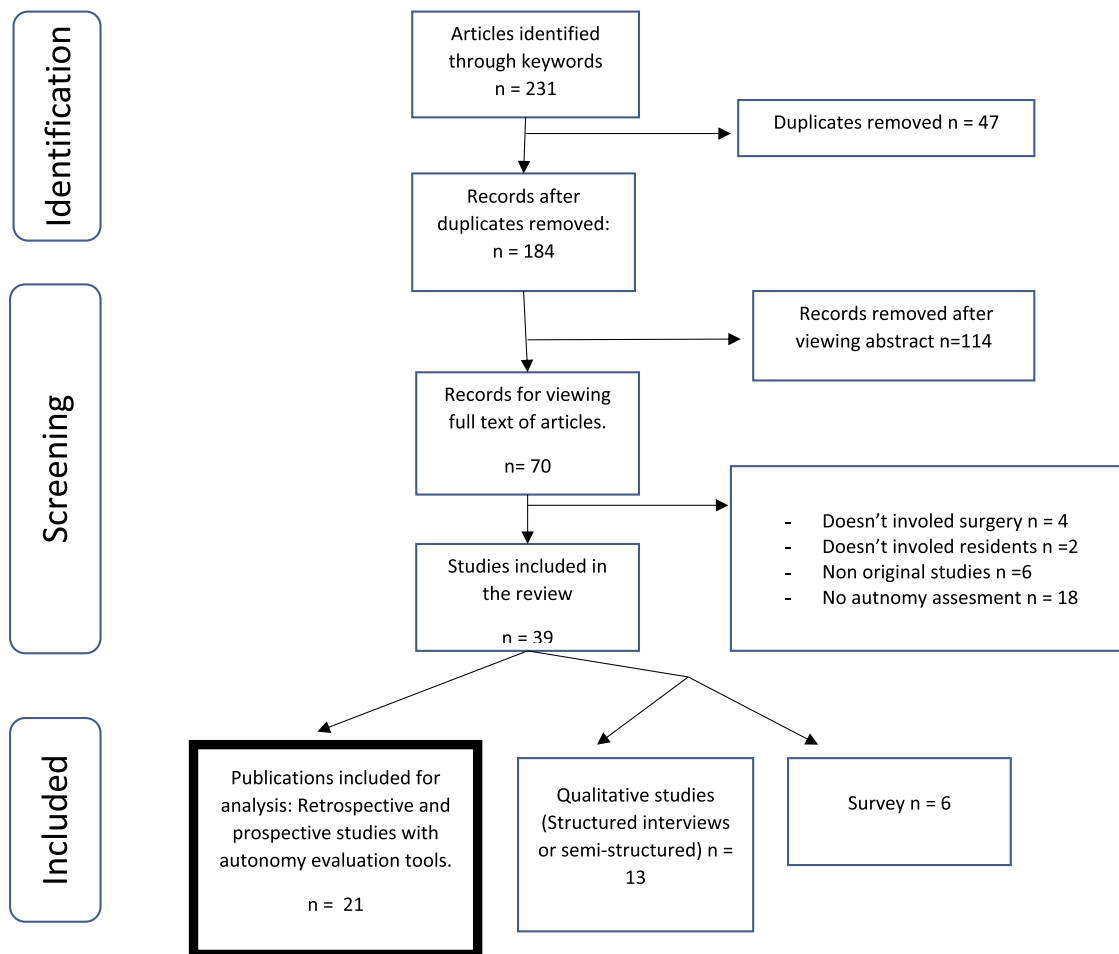


FIG. 1. SWiM flowchart.

### SIMPL and "Zwisch me !!" Tools

The Zwisch Scale tool has also been integrated into a mobile application called Society for Improving Medical Professional Learning (SIMPL, Boston, MA), founded by a non-profit organization.<sup>8</sup> This application allows residents and teachers to grade autonomy directly on their phones immediately after the procedure. The postoperative questionnaire consists of 3 parts. The first one is the same as described above using the Zwisch Scale. The second part assesses surgical performance, which is rated from 1 to 5, including "Unprepared resident," "Resident unfamiliar with the procedure," "Intermediate level of performance," "Performance suitable for future autonomous practice," and "Exceptional performance." The third part involves rating the surgical difficulty from 1 to 3, ranging from easiest to most difficult. Surgical difficulty is defined by the difficulty of the procedure within its category (e.g., appendectomy versus another appendectomy).

Teachers can also provide personalized comments. The initiation of the SIMPL questionnaire response after a procedure can come from either the resident or the surgeon, and the other party will be invited to complete their response afterward.<sup>7,9</sup> Another mobile application called "Zwisch me !!" exists, which aims to collect post-operative autonomy scales from residents.<sup>10</sup> However, it does not assess surgical difficulty or performance in the same session.<sup>11</sup> These scales were developed as part of national projects for the accreditation of surgical residents, along with other clinical, theoretical, and practical evaluations in real-life or simulation settings. Indeed, in several specialties, standardized portfolios for residents have been implemented, which allow for the collection of demographic information and post-operative Zwisch Scale assessments from students and/or teachers. However, there is no obligation in these programs to enter data for each intervention. For a specific procedure, the collection of this information is initiated by the resident or the surgeon.

**TABLE 1.** Demographic Characteristics, Study Design, and Evaluation Tools Used for Included Publications (n = 21)

Authors	Contry	Study Design	Centers	Resident Number	Surgical Specialties	% Women	Interventions Number	Tools to Assess Autonomy	Double Evaluation
J. X. Chen et al. <sup>25</sup>	USA	OR	5	92	Otolaryngology surgery	52%	1746	Zwisch Scale/SIMPL	Yes
Williams et al. <sup>12</sup>	USA	OR	1	123	Multiples	36%	2716	Optrust	Yes
Belvedere et al. <sup>27</sup>	NZ	OR	DNA	120	General surgery	31 %	40,865	First surgeon versus first surgeon autonomy	No
J. X. Chen et al. <sup>29</sup>	USA	OR	71	1863	Multiples	41 %	52,241	Zwisch Scale / SIMPL	Yes
Cooney et al. <sup>23</sup>	USA	OR	3	64	Plastic surgery	25%	8377	OEA	No
Olumolade et al. <sup>32</sup>	USA	OR	1	18	Urology	22%	516	Zwisch Scale/SIMPL	Yes
Cookmaster et al. <sup>20</sup>	USA	OR	1	42	General surgery	35%	2360	Zwisch Scale	Yes
X. P. Chen et al. <sup>6</sup>	USA	PO	4	10	General surgery	DNA	40	SEPA	Yes
Kim et al. <sup>26</sup>	USA	OR	14	619	General surgery	41 %	598	Zwisch Scale/SIMPL	Yes
Joh et al. <sup>5</sup>	NZ	OR	18	120	General surgery	35%	119,380	En autonomie vs Sans autonomie	No
Lane et al. <sup>24</sup>	USA	OR	1	35	General surgery	48%	3574	Zwisch Scale	No
Parker et al. <sup>28</sup>	Kenya	OR	1	11	General surgery	DNA	136	Zwisch Scale	Yes
Meyerson et al. <sup>30</sup>	USA	OR	14	412	General surgery	42%	8900	Zwisch Scale/SIMPL	Yes
Ahle et al. <sup>17</sup>	USA	OR	1	32	General surgery	DNA	530	EOR/SIMPL	Yes
Hoops et al. <sup>18</sup>	USA	OR	1	106	General surgery	50,9%	908	Perception of level of guidance needed	No
H. E. Hoops et al. <sup>19</sup>	USA	OR	1	106	General surgery	DNA	768	Perception of level of guidance needed	No
Sandhu et al. <sup>4</sup>	USA	PO	1	38	Multiples	DNA	67	Zwisch Scale and OpTrust	Yes
Sandhu et al. <sup>21</sup>	USA	PO	1	35	Multiples	DNA	117	OpTrust	Yes
Thompson-Burdine et al. <sup>31</sup>	USA	PO	1	73	Multiples	38%	223	OpTrust	Yes
Meyerson et al. <sup>11</sup>	USA	OR	7	33	Thoracic surgery	18%	596	Zwisch Scale / « Zwisch Me » App	Yes
Williams et al. <sup>16</sup>	USA	OR	14	487	General surgery	DNA	7297	Zwisch Scale / SIMPL	Yes

Abbreviations: ZS: Zwisch Scale ; OEA: The Operative Entrustability Assessment; OR: Observational retrospective study; PO: Prospective observational study; DNA: Data non available; USA: United States of America; NZ: New Zealand; SEPA: Surgical entrustable professional activities; EOR: End-of Rotation Evaluation; SIMPL: Society for Improving Medical Professional Learning.

**TABLE 2.** Summary of Autonomy Evaluation Tools Used

Tools		Publication's Number
Zwisch Scale	Overall	12
	Alone	4
	SIMPL	7
	Zwisch me !!	1
OpTrust		4
Perceived level of guidance needed		2
SEPA's		1
EOR		1
OEA		1
Others		2

Abbreviations: ZS: Zwisch Scale; OEA: The Operative Entrustability Assessment; SEPAs: Surgical entrustable professional activities; EOR: End-of Rotation Evaluation; SIMPL: Society for Improving Medical Professional Learning.

### Optrust and Operative Entrustability Assessment (OEA) Tools

Another parameter called "Entrustability," which refers to the ability to entrust something to someone, evaluates the confidence placed in a resident during a surgical procedure and the sense of safety conveyed by their behavior. Although this slightly differs from the concrete evaluation of autonomy, it remains closely related. The Optrust tool was constructed as a questionnaire to be completed postoperatively by the resident, their senior surgeon, and an external observer. It consists of 5 domains: the type of questions asked, the operative plan, instructions, problem-solving, and leadership. These 5 domains are evaluated on a 1 to 4 scale, ranging from low confidence (given and received) to blind trust.

The relationship between confidence (OpTrust) and autonomy (ZS) has been studied, showing a significant positive correlation ( $p = 0.66$ ,  $p < 0.05$ ) between the confidence given to the resident (as observed) and the perceived level of autonomy through the Zwisch Scale filled out by the student (4). This effect persists even after adjusting for year of residency, gender, or surgical complexity in multivariate analysis ( $OR = 8.42$ ,  $p < 0.001$ ).

A publication studied the impact of the implementation Optrust tools on postoperative complications in general surgery by increasing entrustment. They did not find any statistical difference in postoperative outcome after the implementation of the Optrust tool.<sup>12</sup>

The Operative Entrustability Assessment (OEA) primarily aims to grade surgical performance. It can also partially assess the autonomy granted to a resident.<sup>13</sup> Autonomy is evaluated on a 5-point Likert scale: 1 = Surgeon must perform the entire procedure; 2 = Surgeon physically guides the resident during the procedure; 3 = Surgeon verbally guides the resident during the

procedure; 4 = Resident performs the procedure with minimal assistance; and 5 = Resident performs the procedure independently. It is also available in an online version implemented in software called MileMarker, which allows for self-evaluation by the resident and evaluation by the teacher associated with Current Procedural Terminology (CPT) codes. This tool has also demonstrated empirical reliability in certain specialties such as plastic surgery.<sup>14,15</sup>

### Surgical Entrustable Professional Activities (SEPAs) Instruments

The evaluation of surgical residents' performance in the United States is required by the American Board of Surgery (ABS) for 6 procedures per student. It is conducted using an evaluation scale called the Operative Performance Rating System (OPRS), which assesses specific procedure-related skills and general competencies.<sup>16</sup> However, this evaluation has several limitations, including the presence of a single evaluator who is not external and the absence of assessing autonomy based on operative steps or other areas of competence such as leadership or team management.

For these reasons, the team of Chen et al.<sup>6</sup> created the Surgical Entrustable Professional Activities (SEPAs). The principle is to create a standardized evaluation specific to several major procedures in general surgery, covering a broader range of competence and autonomy domains than the OPRS. They conducted interviews with 43 expert surgeons and 39 residents to create a series of items evaluated using a Likert scale. These items include the level of assistance required at each operative step, total autonomy, confidence in future practice, procedure-specific skills, downtime, overall performance, general competencies, team management, operative planning and application, operative difficulty, and learning during the procedure. After each relevant surgical procedure (e.g., laparoscopic hernia repair), the score resulting from this evaluation would highlight a resident's ability to achieve full autonomy. They found strong evidence of validity for the tool and a significant correlation with the OPRS score. For example, there is a correlation between overall assistance received and predicted confidence in the student, with  $r = 0.67$ ,  $p < 0.0001$ .<sup>6</sup> The SEPAs tool is the only 1 that evaluates autonomy based on each operative step rather than overall autonomy.

### Other Tools

Following the same model of quantifying autonomy coupled with performance measurement in the SIMPL application, the End-of-Rotation Evaluation (EOR) is filled out by the teacher at the end of the rotation (end of the academic year in the United States, equivalent to the end of

**TABLE 3.** Table Showing the Positive and/or Negative Correlations of Zwisch Scale and Optrust With Years of Experience, Surgical Difficulty, Multiple Interventions, Evaluation Timing, Resident's Year of Training, and Performance

	Zwisch Scale		Optrust	
	Correlation +	Correlation -	Correlation +	Correlation -
Factors Dependent on the Teacher:				
Years of experience		- (20)		-(21)
Factors Dependent on the Context or Patient:				
Surgical difficulty		-(24; 11 ; 25)		-(4 ; 21)
Multiple interventions		-(25)		
Evaluation timing (Begging or end of semester)		-(25)		
Factors dependent on the Resident:				
Resident's year of training	+ (4;11;17;22; 24; 25;20)		+(4)	
Performance	+(17; 22)			

a semester in France).<sup>17</sup> This evaluation typically includes 20 items to be completed on a Likert scale, including autonomy, communication, technical skills, practical learning and professionalism, among others. This evaluation showed a positive correlation with the assessment of autonomy and performance using the SIMPL tool (Pearson correlation of 0.55). The evaluation of autonomy alone using the Zwisch Scale was correlated with the EOR in the majority of items (e.g., technical skills: 0.50; technical autonomy: 0.59). Although, EOR is not standardized in all institutions and may include different items.

Autonomy has also been assessed based on the "Perceived level of guidance needed" by a resident during a surgical procedure. Students can be rated in 3 categories: strongly needed, needed, very little needed, or not needed at all.<sup>18,19</sup> This evaluation was also included in a more comprehensive questionnaire that encompassed performance evaluation, operative difficulty, the resident's medical knowledge, communication, and professionalism, known as Procedure Feedback Forms (PFF). The questionnaire is also filled out postoperatively at the initiative of the student.

During our literature review, we found a significant number of publications based on questionnaires (n = 6) or structured or semistructured interviews (n = 13). Although these study models also provide insights into autonomy, they were not analyzed in our study. Despite the low level of evidence from these studies, they nevertheless provide an overview of practices and obtain the opinions of teachers and residents regarding autonomy in the operating room.

### FACTORS ASSOCIATED WITH RESIDENT AUTONOMY IN THE OPERATING ROOM

Within the analyzed publications, several studies aimed to evaluate factors influencing the attainment of autonomy

in the operating room by residents, either positively or negatively. These factors are multiple and interconnected and can originate from the student, teacher, context, or patient. Three main factors were identified: surgical complexity, year of residency, and performance. The positive and negative correlations with respect to the autonomy assessment tool used are presented in [Table 3](#).

#### Factors Dependent on the Teacher

In our review, the experience of the teacher appears to be negatively associated with the autonomy granted to residents in the operating room. Teachers with more than 10 years of experience are less likely to grant autonomy to residents compared to those with less than 10 years of experience (OR 0.62, p < 0.0019).<sup>20</sup> This effect is observed when using the OpTrust tool, with the average confidence score reported by the student being 2.22 (standard deviation = 0.78) for 1 to 5 years of experience compared to 2.04 (standard deviation = 0.78) for >15 years of experience (p = 0.62).<sup>21</sup> However, some teachers have a habit of more readily granting autonomy to residents regardless of the student's years of experience.<sup>22</sup> Regarding the gender of the teacher in evaluating residents, studies show contradictory results. There is a significant decrease in autonomy granted to female residents compared to male residents, but only when the teacher is also male.<sup>23</sup> However, no significant differences in autonomy were found between male and female residents when the evaluator was a female. This trend is not observed in all studies, with some showing the opposite effect. If the evaluator is female, both male and female residents were less likely to acquire autonomy compared to when the evaluator was a male evaluating a male resident.<sup>20</sup>

#### Factors Dependent on the Context or Patient

Regarding the context, the surgical difficulty is a logical factor negatively influencing resident autonomy. The

more complex the procedure, the less likely the teacher will be able to grant autonomy. For example, the chance of significant autonomy (Zwisch Scale  $\geq 3$ ) decreases during difficult procedures compared to simple or moderately difficult procedures (OR 0.35 [95% CI, 0.29-0.42] and OR 0.08 [95% CI, 0.06-0.11]).<sup>24</sup> However, the definition of surgical difficulty varies across studies, with most evaluating intrinsic difficulty or difficulty of the case compared to other procedures in the same category. The Accreditation Council for Graduate Medical Education (ACGME) has defined 3 categories of surgical difficulty (basic, advanced, or complex) in which all visceral surgical interventions are classified.<sup>19</sup> There is also a significant difference in autonomy between minor thoracic interventions and major cardiac interventions in thoracic surgery ( $p < 0.001$ ).<sup>11</sup> The presence of multiple procedures during a single operation also negatively impacts access to autonomy.<sup>25</sup> The time period of the year can also be positively associated with autonomy. At the end of the academic year or rotation within the same team, there is an increase in autonomy.<sup>25,26</sup> This can be explained by the progression curve as well as the relationship and trust established between the teacher and student. However, no observational studies evaluating the impact of time pressure in the operating room on autonomy were found. There is also no evaluation of autonomy based on specific patient characteristics (body mass index, urgency, adhesions, etc.).

### Factors Dependent on the Resident

Regarding factors specific to the resident, autonomy assessments appear to be positively correlated with the year of residency in the majority of studies that examined this factor.<sup>4,17,22,24,25</sup> The degree of autonomy assessed by the OpTrust and Zwisch Scale scores is significantly different based on the resident's year of study ( $p < 0.001$  and  $p < 0.002$ , respectively).<sup>4</sup> Performance, being multidimensional, also requires complex tools for evaluation. There is a correlation between the performance scale of the SIMPL application and the autonomy granted in the operating room (correlation coefficient  $\rho = 0.57$ ).<sup>22</sup> However, simulation performance was not significantly associated with greater autonomy, regardless of the year of residency (1st year  $p = 0.6$ , 2nd year  $p = 0.96$ , 3rd year  $p = 0.25$ , 4th year  $p = 0.83$ ).<sup>19</sup> The resident's theoretical knowledge of the procedure can also be a predictor of autonomy in the operating room ( $p < 0.001$  for all years of residency).<sup>19</sup> The number of previous interventions of the same type in which the resident has participated is positively associated with access to significant autonomy. In multivariate analysis, being the primary operator for a Hartmann procedure was significantly associated with the number of prior Hartmann

interventions in which the resident participated during their residency (OR 1.756; CI 1.399-2.224,  $p < 0.001$ ).<sup>27</sup>

The resident's personality likely plays a role in achieving autonomy in the operating room, with disparities in the demand for autonomy or perceptions of their own capabilities. Underestimation of autonomy by the resident is found in several studies, although 60% of cases show similar autonomy ratings between the student and teacher, with only 3.4% of cases showing a difference of more than 1 point.<sup>26</sup> Resident hesitation during a procedure is negatively associated with their Zwisch scale score, whether it is self-reported or reported by the evaluator ( $-0.29$ ,  $p < 0.001$  and  $-0.34$ ,  $p < 0.001$ , respectively).<sup>28</sup>

Among the included publications, 10 (50%) of them aimed to evaluate the impact of resident gender on autonomy or perceived autonomy by the student. Additionally, 3 other studies sought to highlight gender disparities in autonomy.<sup>5,20,26</sup> In total, 5 publications found a significant difference in autonomy granted based on resident gender when autonomy was assessed by the teacher, with female residents receiving less autonomy than male residents.<sup>11,18,23,29,30</sup> When evaluating over 8000 plastic surgery procedures, the mean OEA score was 3.46 for male residents and 3.14 for female residents ( $p < 0.001$ ).<sup>23</sup> Furthermore, 3 publications found this effect only when autonomy was self-assessed by the resident.<sup>5,20,25</sup> Therefore, there is an interest in evaluating gender disparities by comparing self-assessment with teacher evaluation. In some studies, female residents showed significantly lower autonomy in self-evaluations compared to male residents, while the combination of both evaluations (senior surgeon and resident) did not show a significant difference.<sup>20</sup> Women seem to have a diminished perception of the quantity and quality of autonomy they receive. In our study, 4 publications did not find a significant difference based on gender.<sup>21,24,25,31,32</sup> When a third observer was present and the OpTrust tool was used, no significant difference was found based on resident gender in the autonomy granted, whether based on self-evaluation, teacher evaluation, or the presence of a third observer.<sup>31,32</sup>

### AUTONOMY IN OBSTETRICS AND GYNECOLOGY

We did not find any studies evaluating the autonomy granted to obstetrics and gynecology residents among the studies that used standardized tools in observational settings. Two publications, based on qualitative interviews (not included in the final analysis), focused on obstetrics and gynecology residents.<sup>33,34</sup> The first study conducted interviews with 27 senior obstetrician-gynecologists, while the second study evaluated residents'



perspectives through focus group discussions to assess their perception of autonomy, expectations regarding autonomy, and self-confidence. These studies raise new issues specific to gynecology, including a greater interest among students in acquiring autonomy in complex obstetrical interventions compared to gynecological surgeries. They also report that self-confidence is an important factor for autonomy: students who are confident in their practice are more likely to seek autonomy from seniors. Communication also appears to be a determining factor from the perspective of both residents and surgeons.

## DISCUSSION

It has been demonstrated that progressive exposure to autonomy during residency is an important condition for initiating independent and confident practice.<sup>35</sup> The SIMPL tool and Zwisch Scale appear to be reliable instruments for quantifying autonomy in the operating room, especially when implemented in training programs. However, they are predominantly evaluated on a voluntary basis, and data collected on residents' autonomy during surgical procedures are not systematic. Residents and teachers who are more diligent in evaluating autonomy in the postoperative period are more likely to perceive its relevance to their practice.<sup>36</sup> When a student receives significant autonomy in the operating room, it can be hypothesized that they are more likely to integrate it into their skill set. Many publications highlight an underestimation by the resident of their autonomy compared to what the teacher believes they have granted.<sup>26</sup> This can also be explained by biases in the interpretation of questions and responses. It is sometimes difficult for students or teachers to determine the boundary between teaching additional concepts and providing guidance due to a lack of autonomy, which can result in a perceived decrease in autonomy by the student even though it may be part of the educational process.<sup>37</sup> The data collection methods are not homogeneous in these studies, including the use of mobile applications that can facilitate data collection from residents. It may be beneficial to employ a dual evaluation (by the teacher and the resident) to mitigate the potential bias of underestimation by the resident.

Other variables need to be considered in the statistical analysis of autonomy granted to a resident, such as surgical complexity, year of residency, and performance. We did not find any studies evaluating the resident's rapport with the surgeon as a factor that could influence the autonomy granted in the operating room. It is known that a regular surgeon-resident pair is more likely to promote progressive autonomy for the resident.<sup>38</sup>

The influence of resident gender appears to be a current topic with numerous recent publications. Despite conflicting results regarding differences in autonomy between male and female residents in the operating room, it is important not to overlook the factors of discrimination still present within institutions. Another noteworthy point is the difference found in several studies regarding self-evaluation by women compared to evaluation by their teachers. This tendency for self-underestimation among women is observed in many non-medical fields, including sports.<sup>39</sup>

The postoperative complications resulting from a resident's involvement in surgery can be a source of concern for surgeons, leading to a reluctance to provide teaching opportunities. It is seen as one of the most limiting factors in granting autonomy.<sup>40</sup> However, in the literature, the participation of a student (including complete autonomy or even supervising a junior resident) during a surgical procedure does not necessarily lead to an increase in postoperative complications.<sup>41,42</sup> Nevertheless, postoperative complications remain rare events that are difficult to ascertain. The trust a patient places in their surgeon can be a limiting factor for the teacher.

For example, patients who have undergone a hysterectomy express a desire to know the involvement of a student without being opposed to it.<sup>43</sup> On the other hand, when a resident actively participates in a surgery, it can prolong the operative time and create intentional barriers related to efficiency and safety regarding granting autonomy.<sup>44</sup> One might think that a more experienced teacher would be more likely to grant autonomy to a resident. However, our analysis did not confirm this, showing a trend toward less autonomy when the operator is experienced. This can be explained by the nature of surgical procedures performed by senior physicians, who are often confronted with the most complex cases. In the literature, from the residents' perspective, it is also found that the teacher's experience or surgical performance is not a determining factor in their learning in the operating room. The teacher's personality, teaching techniques, or ability to involve the resident in patient care are qualities that are likely to grant autonomy.<sup>45</sup>

The complete absence of publications conducted in France or within the field of obstetrics and gynecology raises questions. In France, there is no systematic or non-systematic data collection system for simple procedures that can be used in daily practice. Studies are needed to evaluate the external validity of the tools used in the United States and to officially translate them. This is further accentuated by the significant disparity between American and French residency programs, with France having a longer duration of residency (6 years versus 4 years in the United States).

Obstetrics and gynecology is underrepresented in the study of autonomy, despite indications that obstetrics and gynecology residents tend to underestimate their performance compared to residents in other surgical specialties. Conducting studies to evaluate autonomy could help address this bias in surgical education.<sup>46</sup> Regarding future publications, there is a specific evaluation tool for assessing a student's performance during laparoscopic hysterectomy called Hysterectomy observed structured assessment of technical skill (H-OSAT).<sup>47</sup> It details the operative steps and skills to be acquired to provide a performance evaluation. A French study has evaluated its validity for several items.<sup>48</sup> It would be interesting to assess, for each operative step, the level of autonomy that can be granted to a resident based on their year of residency.

## CONCLUSION

Our study analyzed 17 retrospective cohort publications and 3 prospective ones. Due to the complex nature of defining autonomy, there is heterogeneity in the tools used to quantify the autonomy of surgical residents. Among them, the SIMPL tool and the Zwisch Scale appear to be the most frequently used. The strong relationship between autonomy, performance, confidence, and knowledge may require multidimensional tools that encompass various competency domains, but their practical implementation on a daily basis may be challenging. There is a significant lack of data on autonomy in the operating room in France, as well as a lack of evaluation in the field of gynecology-obstetrics worldwide.

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