

# The WHO Surgical Safety Checklist in Belgian hospitals: Changes in use, knowledge, opinions and perception of pressure among operating room professionals between 2016 and 2021

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## Abstract

**Background:** Implementing a Surgical Safety Checklist (SSC) poses several challenges. Operating room (OR) professionals' opinions on SSC determine whether it is used. Additionally, OR professionals often complain of pressure for execution and presence of inappropriate components in the SSC.

**Objectives:** This study aimed to investigate whether the use of and opinions on SSC improved, and whether feelings of pressure and opinions on the appropriateness of the items changed.

**Design:** Repeated cross-sectional study.

**Setting:** An online survey was sent to all Belgian OR professionals (nurses, surgeons, and anesthesiologists) in 2016 and 2021.

**Methods:** Respondent characteristics were summarized using the proportions of discrete variables. Other data were analyzed using Pearson's chi-squared test or Fisher's exact test. A p-value (0.01) was considered statistically significant.

**Results:** In 2021, participation increased from 1419 to 2166 OR professionals. More participants stated that they used SSC, and that its use was more systematic. Opinions about SSC revealed a significant change in patients' appreciation of SSC use (more positive) and signs of a lack of knowledge of the patient file (less negative). More negative feelings were observed when the SSC was not used. The OR staff experienced less time pressure to complete the SSC. Surgeons, anesthesiologists, and colleagues exerted more pressure on SSC use. The pressure for not using the SSC was low. Seven of the 22 SSC components were judged more appropriate by 2021. 'Time Out' improved more than 'Sign In' or 'Sign Out'. Team member introduction remained the least-supported component.

**Conclusion:** SSC was used more often in 2021. Most of the opinions were positive. There was more pressure to use SSC. Most components were considered appropriate, except for team introduction. Local adjustments can align needs with the staff's opinions. However, crucial components must be maintained.

**Keywords:** Patient Safety, Checklist, Operating Rooms, Guideline Adherence.

## Introduction

The use of the Surgical Safety Checklist (SSC) in the operating theatre has been promoted by the

WHO since January 2009, with the aim of reducing the number of patient safety incidents (wrong patient, wrong site, wrong procedure, etc.), reducing comorbidities, and saving patients' lives<sup>1,2</sup>. Since

*Preliminary data from the 2016 survey were presented at the 70th PostGraduate Assembly of NYSSA (New York, 2016); Euroanaesthesia 2017 (Geneva), and SFAR 2017 (Paris). Preliminary data from the 2021 survey were presented at Euroanaesthesia 2021 (Munich) and at the International Forum on Quality and Safety in Healthcare 2022 (Gothenburg). The study was approved by the Committee for Medical Ethics of Sint-Blasius General Hospital, Kroonveldlaan 50, 9200 Dendermonde (chair Dr. S. Serry) on December 15, 2015, and January 5, 2021 (B0122021000001). The requirement for informed consent was waived.*

the introduction of the SSC several studies have confirmed reduction in morbidity and mortality with its use<sup>3-11</sup>.

SSC has been included in the International Patient Safety Goals by most hospital accreditation organizations<sup>12</sup>. Since 2011, the Belgian Federal Public Service Health, Food Chain Safety and Environment has recommended the use of SSC through repetitive campaigns: 'Good Surgery is Safe Surgery' (<https://www.health.belgium.be/nl/gezondheid/organisatie-van-de-gezondheidszorg/kwaliteit-van-zorg/patientveiligheid/safe-surgery#article>). Its use is mandatory in operating theatres in Flanders, Belgium's northern region<sup>13</sup>.

Nevertheless, the implementation of SSC is a laborious process, with several challenges. Operating room (OR) professionals have distinct feelings and opinions regarding the use of SSC, which determine whether SSC will be used. In addition, OR professionals often complain of pressure to perform SSC and the presence of inappropriate elements in the SSC<sup>14-19</sup>.

This study aimed to investigate whether SSC use, as part of the patient safety culture, improved in Belgian hospitals between 2016 and 2021. Did knowledge and opinions improve, did feelings of pressure change, and did opinions about the appropriateness of SSC components in the checklist change? We hypothesized that opinions and feelings would be more positive, OR professionals would experience more pressure to use SSC and less pressure to not use SSC, and that more components of SSC would be deemed appropriate.

## Methods

### *Study design and setting*

Using a repeated cross-sectional study design, an online questionnaire (SurveyMonkey®) was sent to all eligible OR professionals (nurses, surgeons, and anesthesiologists) in Belgian hospitals in 2016 and in 2021. With the assistance of the Quality Cell of the Federal Public Service of Health and Zorgnet-Icuro vzw, the umbrella organization of Flemish general hospitals, an informative mail with a direct link to the survey was sent to the patient safety coordinators and medical directors of all Belgian hospitals with an operating theatre, requesting that the mail be forwarded to all the OR professionals. After two and four weeks, a reminder was sent. The survey and mail were drafted and sent in Dutch, French, and English languages. In 2016, the survey was presented in Flanders between February 15 and March 29, and in Brussels and Wallonia between September 12 and October 21. The 2021 survey was conducted at all Belgian hospitals between February 15 and March 31.

## *Questionnaire and variables*

### *The survey consisted of five parts*

Part 1 explored the demographics of the participating OR staff: region (Wallonia, Brussels, or Flanders in 2021; in 2016, Wallonia and Brussels were seen as one region), type of profession (anesthesiologist, surgeon, nurse), years of experience (<1y, >1y, >5y, >10y, >20y), accreditation status of the hospital (yes, no), and hospital size (<200 beds (small), <500 beds (medium-sized), <1000 beds (large), >1000 beds (very large)).

Part 2 explored whether the SSC was used, which type of SSC was used (exact copy or modified version), and the estimated actual use of SSC as a percentage of all OR cases (>98%, 90-98%, 75-89%, 50-74%, <50%).

Part 3 explored opinions and feelings about the SSC using a forced Likert scale (totally agree, partially agree, partially disagree, totally disagree).

Part 4 assessed the perception of pressure exerted (by surgeons, anesthesiologists, colleagues, heads of department, and management) to use the SSC using a forced Likert scale (always, often, rarely, never).

A 4 item Likert scale was used to force the participants to take a clear position for Parts 3 and 4. The data on the Likert scale were reduced to two categories (agree and disagree) for further analysis.

Part 5 assessed opinions regarding the appropriateness of the SSC components (necessary or redundant).

In 2016, it was not mandatory to answer the questions, resulting in a different number of respondents per question. In 2021, this problem was addressed by requiring an answer to each question.

As all the questions from the survey were considered independent hypotheses, an unanswered question by a participant was not considered a missing value. As expected, the dropout rate during the survey was 10.6% in 2016 and 8.8% in 2021 ( $p = 0.037$ )<sup>20</sup>.

### *Study Size*

We estimated the overall OR staff of over 40,000 professionals based on publications by the Belgian Federal Public Service of Health, Food Chain Safety, and Environment<sup>21</sup> and by the Flemish Agency of Care and Health (<https://www.zorg-en-gezondheid.be/ziekenhuispersoneel>). In 2016, more than 10,000 physicians were licensed to work in the OR. As there are three nurses per physician, according to data from the Flemish Agency, approximately 40,000 people (physicians and nurses) work in the operating room. An adequate sample size would consist of 1040 participants, using a confidence interval of 95% and margin of error of 3%.

### Bias

Response bias (participants did not answer the questions correctly but gave the answers they thought they were supposed to give), non-response bias (participants who did not like the use of the SSC were probably more likely to be reluctant to take a survey on this topic), and attrition bias (participants who dropped out differed from those who completed the survey) were minimized by performing the same survey twice. Sampling bias was minimized by inviting all OR professionals in Belgian hospitals to complete the survey.

### Statistical methods

Respondent characteristics were summarized using proportions for discrete variables. Differences in knowledge, opinions, and perceptions of pressure were analyzed using Pearson’s chi-squared test or Fisher’s exact test, as appropriate, using free online software (Vassar Stats®, <https://www.vassarstats.net>) and XLSTAT (Addinsoft, 2021, <https://www.xlstat.com>). For Parts 3, 4, and 5, subgroup analysis was performed for professional groups, experience, and hospital size. A more severe p-value (0.01) was considered statistically significant to correct for multiple testing, thereby limiting the number of false positives.

### Ethical considerations

This study was approved by the Committee for Medical Ethics of Sint-Blasius General Hospital, Kroonveldlaan 50, 9200 Dendermonde (chair Dr. S. Serry) on December 15, 2015, and January 5, 2021 (B0122021000001). The requirement for informed consent was waived. The survey was compliant with the European Global Data Protection Ruling. Participants were informed that data collection would be kept anonymous and considered confidential. IP addresses were removed from the dataset immediately after the data collection was completed. No incentives were provided to complete the survey.

### Results

#### Participants (Fig. 1, Fig. 2)

In 2016 and 2021, 1538 and 2321 OR professionals, respectively, started the survey. Twenty-two and 57 participants stopped before the question “Do you use an SSC?”. For 97 and 98 participants, the survey was stopped after they stated that they did not use SSC or knew whether it was being used. The remaining OR professionals (1419 vs. 2166) continued the survey, increasing the participation rate by 52.6% in 2021 ( $p < 0.0001$ ). In the 2016 survey, it was not mandatory to answer all questions before continuing to the next

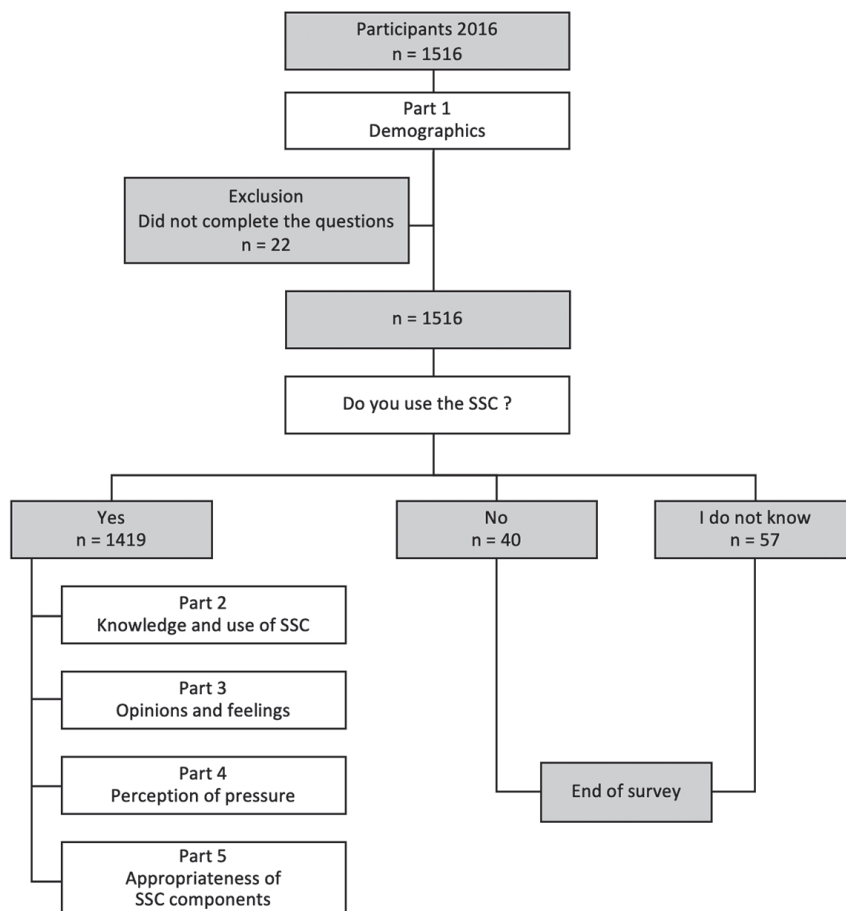


Fig. 1 — Flow Chart Survey 2016.

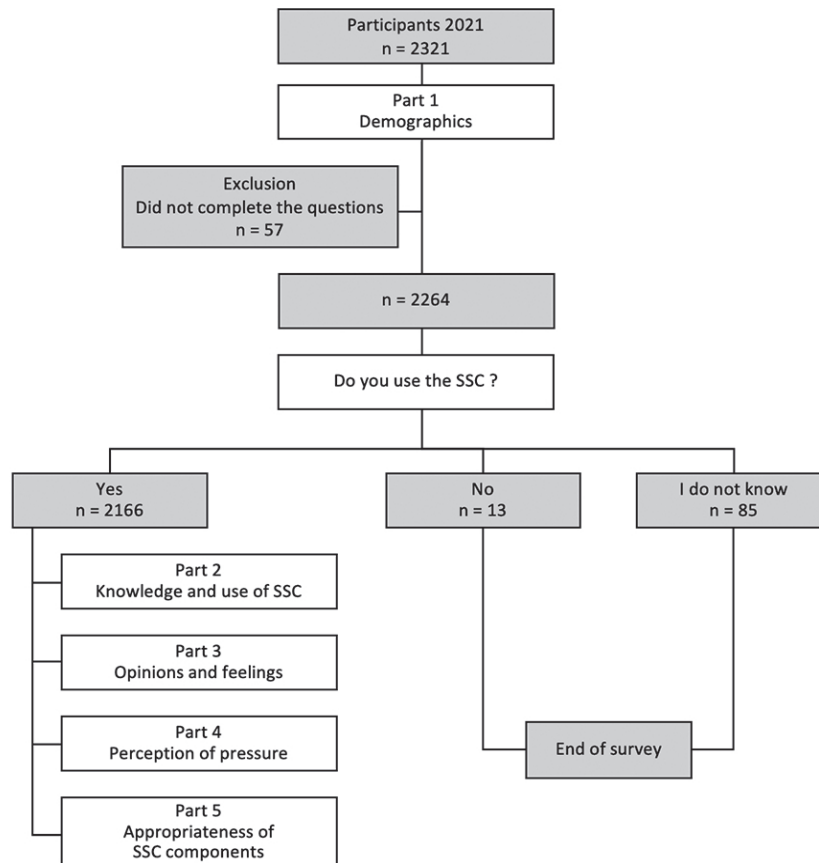


Fig. 2 — Flow Chart Survey 2021.

set of questions. This caused minimal variation in the response rate for the different questions per section due to participants who skipped a question without notice. This problem was accounted for in 2021, making it mandatory to answer all questions before proceeding to the next section.

### Demographics (Table I)

Compared with 2016, the participation of anesthesiologists decreased, and the participation of nurses increased significantly. No significant differences were observed in OR experience. The response rate of very large hospitals increased significantly, whereas that of small and medium-sized hospitals decreased.

Due to differences in data collection concerning the region of the hospital between 2016 and 2021, data about the region could not be used for further analysis.

A significant increase has been observed in the number of hospitals accredited by 2021. Due to differences in hospital accreditation policies between the different regions of Belgium, no further analyses were performed.

### Knowledge (Table II)

Almost all OR professionals in Belgian hospitals use SSC. The percentage of participants who stated that they used SSC improved significantly. In 2021,

knowledge about the format of SSC decreased significantly; 44.7% did not know whether they used the original WHO SSC or an adapted version versus 30.4% in 2016. SSC was used more systematically in 2021. Its use in >98% of cases increased from 25.1% (2016) to 39.6% (2021). Its use in 90-98% of cases was identical. In other groups, a decrease was observed in 2021. The percentage of patients who reported the use of SSC in less than 50% of cases did not change significantly.

### Opinions and feelings about the SSC (Table III)

#### Positive opinions

In 2016, 89.5% or more of the participants supported all positive opinions except 'patient appreciation'. These opinions were confirmed in 2021. Only the opinion that patients appreciated the use of SSC significantly improved. Subgroup analysis showed an increase for 'patient appreciation' among staff with >10y experience. Among staff with >5y experience, there was a growing belief that the risk of mistakes in the type of surgery was lower. In small hospitals, the opinion that SSC improved patient safety increased significantly.

#### Negative opinions

In 2016, 31.5% indicated that repeated identity checks annoyed the patients. Interestingly, this

**Table I.** — Demographics.

DEMOGRAPHICS 2016		n participants		%	%	$\chi^2$ test
		2021		2016	2021	
PROFESSION	Anaesthesiologist	375	469	24.8	20.7	p=0.001
	Surgeon	485	694	32.2	30.6	
	Nurse	650	1110	43.0	48.6	
OPERATING ROOM EXPERIENCE	<1 year	81	105	5.4	4.6	p=0.038
	>1 year	234	420	15.5	18.6	
	>5 years	270	393	17.8	17.4	
	>10 years	408	538	26.9	23.7	
	>20 years	521	808	34.4	35.7	
HOSPITAL SIZE	Small (<200 beds)	123	117	8.1	5.2	p<0.0001
	Medium-sized (>200 beds)	607	728	40.1	32.1	
	Large (>500 beds)	569	897	37.6	36.9	
	Very large (>1000 beds)	215	522	14.2	23.1	
HOSPITAL ACCREDITATION	Yes	737	1907	48.8	84.2	p<0.0001
	No or I don't know	774	357	51.2	15.8	

**Table II.** — Knowledge about the use and type of SSC.

KNOWLEDGE ABOUT THE USE AND TYPE OF SSC 2016		n participants		%	%	$\chi^2$ test	Fisher Exact
		2021		2016	2021		
DO YOU USE THE SSC?	Yes	1419	2166	93.6	95.6	p<0.0001	p=0.005
	No	40	13	2.6	0.6		p<0.0001
	I do not know	57	85	3.8	3.8		p=1.000
FORMAT OF THE SSC	Original WHO	116	151	8.9	7.1	p<0.0001	p=0.057
	Adapted WHO	783	1027	60.4	48.2		p<0.0001
	I do not know	398	953	30.7	44.7		p<0.0001
THE SSC IS USED IN ... % OF CASES	> 98	325	844	25.1	39.6	p<0.0001	p<0.0001
	90-98	426	702	32.9	32.9		p=1.000
	75-89	303	350	23.4	16.4		p<0.0001
	50-74	157	138	12.1	6.5		p<0.0001
	<50	84	97	6.5	4.6		p=0.018

number did not change significantly by 2021. Significantly fewer participants felt that the use of SSC indicated insufficient knowledge of patient records in 2021. Less than 10% of the participants supported other negative opinions without significant changes between years. Subgroup analysis showed that in large hospitals, fewer participants indicated SSC use as a sign of weakness or lack of knowledge of the patient record.

*Feelings*

Significantly more participants felt bad about not completing the checklist by 2021. Fewer participants did not have sufficient time to complete the SSC. Stress when using SSC was rare in 2016 and 2021, with no significant changes. Subgroup analysis showed that more negative feelings were

present among surgeons, nurses, staff with >5y and >10y experience, and in medium-sized and large hospitals when the SSC was not used. Among anesthesiologists, staff with >5y experience and in very large hospitals, fewer participants stated a lack of time to complete the SSC.

*Feelings of pressure when using the SSC (Table IV)*

*Pressure to use the checklist*

In 2021, significantly more participants indicated that surgeons, anesthesiologists, and colleagues exerted more pressure to use SSC. Although the largest increase was observed in the group of surgeons, it appears that they still had the least incentive to use SSC. Hospital management and department heads most often encouraged the use of SSC, although no significant changes were observed.

Table III. — Opinions and feelings about the SCC.

OPINIONS & FEELINGS ABOUT THE SCC	n participants		%		2016 vs. 2021 ANE	PROFESSIONAL GROUP			OPERATING ROOM EXPERIENCE					HOSPITAL SIZE (n beds)			
	2021	2016	2021	2016		SURG	NURSE	<1y	>1y	>5y	>10y	>20y	<200	>200	>500	>1000	
																	2021
POSITIVE OPINIONS	1281	1995	91.6	91.9	p=0.777	p=0.297	p=0.574	p=0.823	p=0.722	p=0.206	p=0.037	p=0.428	p=0.546	p=0.167	p=0.921	p=0.801	p=0.174
	1279	1995	93.7	93.7	p=1.000	p=0.348	p=0.262	p=0.691	p=1.000	p=0.368	p=0.026	p=0.702	p=0.397	p=0.036	p=0.862	p=0.627	p=0.107
	1278	1995	89.5	91.7	p=0.032	p=0.016	p=0.742	p=0.048	p=0.513	p=0.500	p=0.001 (21>16)	p=0.334	p=0.831	p=0.287	p=0.316	p=0.040	p=0.471
	1114	1995	89.9	91.3	p=0.189	p=0.207	p=0.907	p=0.232	p=1.000	p=0.928	p=0.053	p=0.323	p=0.967	p=0.145	p=0.865	p=0.059	p=0.116
	1276	1995	92.3	93.4	p=0.245	p=0.107	p=0.868	p=0.629	p=0.664	p=0.738	p=0.154	p=0.112	p=0.505	p=0.009 (21>16)	p=0.198	p=0.916	p=0.108
	1273	1995	76.3	81.6	p=0.0003 (21>16)	p=0.039	p=0.228	p=0.011	p=0.423	p=0.372	p=0.371	p=0.001 (21>16)	p=0.054	p=0.127	p=0.014	p=0.108	p=0.175
	1278	1995	91.6	92.2	p=0.538	p=0.135	p=0.937	p=0.564	p=0.560	p=0.269	p=0.442	p=0.435	p=1.000	p=0.434	p=0.425	p=0.641	p=0.197
	1279	1995	31.5	30.7	p=0.603	p=0.099	p=0.656	p=0.023	p=0.699	p=0.121	p=0.493	p=0.498	p=0.198	p=0.967	p=0.630	p=0.382	p=0.839
	1272	1995	4.3	3.0	p=0.050	p=0.227	p=0.399	p=0.177	p=0.418	p=0.134	p=0.773	p=0.158	p=0.527	p=0.744	p=0.873	p=0.523	p=0.001 (16>21)
	1274	1995	4.3	3.7	p=0.310	p=0.877	p=0.133	p=0.747	p=0.143	p=0.426	p=1.000	p=0.956	p=0.696	p=1.000	p=0.937	p=0.495	p=0.115
NEGATIVE OPINIONS	1277	1995	10.9	7.6	p=0.001 (16>21)	p=0.085	p=0.059	p=0.032	p=0.983	p=0.213	p=0.061	p=0.088	p=0.067	p=0.773	p=0.388	p=0.037	p=0.002 (16>21)
	1273	1995	7.1	6.7	p=0.655	p=0.443	p=0.497	p=0.541	p=0.472	p=0.572	p=0.441	p=0.767	p=0.959	p=0.566	p=0.479	p=0.442	p=0.840
	1275	1995	6.3	5.7	p=0.470	p=0.652	p=0.785	p=0.741	p=1.000	p=0.854	p=0.287	p=0.194	p=0.646	p=0.189	p=0.521	p=0.560	p=0.671
	1276	1995	57.4	65.8	p<0.0001 (21>16)	p=0.071	p=0.004 (21>16)	p=0.001 (21>16)	p=0.899	p=0.528	p=0.001 (21>16)	p=0.001 (21>16)	p=0.016	p=0.923	p<0.0001 (21>16)	p=0.001 (21>16)	p=0.688
	1275	1995	48.9	42.7	p=0.0004 (16>21)	p=0.003 (16>21)	p=0.122	p=0.016	p=0.973	p=0.079	p=0.006 (16>21)	p=0.226	p=0.083	p=0.226	p=0.323	p=0.025 (16>21)	p=0.006 (16>21)
FEELINGS	1279	1995	8.0	7.4	p=0.559	p=0.287	p=0.895	p=0.490	p=0.096	p=0.017	p=0.205	p=0.984	p=0.528	p=0.504	p=0.226	p=0.071	
	1279	1995	8.0	7.4	p=0.559	p=0.287	p=0.895	p=0.490	p=0.096	p=0.017	p=0.205	p=0.984	p=0.528	p=0.504	p=0.226	p=0.071	

**Table IV.** — Perception of pressure when using the SSC.

PERCEPTION OF PRESSURE WHEN USING THE SSC 2016	n participants		%		2016 vs. 2021 ANE	PROFESSIONAL GROUP			OPERATING ROOM EXPERIENCE						HOSPITAL SIZE (n beds)			
	2021	2016	2021	2016		SURG	NURSE	<1y	>1y	>5y	>10y	>20y	<200	>200	>500	>1000	p	
																		p<0.0001 (21>16)
PRESSURE TO USE THE SSC FROM	Anesthesiologist	841	1458	43.3	50.7	p=0.001 (21>16)	/	p=0.0001 (21>16)	p=0.279	p=0.006 (21>16)	p=0.010	p=0.109	p=0.175	p=0.033	p=0.490			
	Surgeon	853	1325	17.7	32.4	p<0.0001 (21>16)	/	p<0.0001 (21>16)	p<0.0001 (21>16)	p<0.0001 (21>16)	p<0.0001 (21>16)	p=0.001 (21>16)	p=0.004 (21>16)	p<0.0001 (21>16)	p=0.026			
	Colleague	1166	1808	52.6	62.6	p<0.0001 (21>16)	p=0.002 (21>16)	p=0.073	p=0.114	p=0.031	p<0.0001 (21>16)	p<0.0001 (21>16)	p=0.113	p=0.001 (21>16)	p=0.142			
	Head of department	1093	1736	72.9	74.4	p=0.394	p=0.720	p=0.077	p=0.695	p=0.144	p=0.517	p=0.582	p=0.722	p=0.847	p=0.125	p=0.544		
PRESSURE NOT TO USE THE SSC FROM	Management	1126	1736	77.8	77.7	p=0.995	p=0.843	p=0.415	p=0.872	p=0.837	p=0.412	p=0.597	p=0.281	p=0.179	p=0.856	p=0.852		
	Anesthesiologist	815	1432	10.8	7.4	p=0.006 (16>21)	/	p=0.045	p=0.374	p=0.050	p=0.178	p=0.095	p=0.569	p=0.176	p=0.668	p=0.013		
	Surgeon	833	1311	25.3	24.0	p=0.470	p=0.798	p=0.330	p=0.696	p=0.313	p=0.688	p=0.471	p=0.713	p=0.602	p=0.845	p=0.434		
	Colleague	1144	1819	5.4	4.5	p=0.232	p=0.576	p=0.403	p=0.708	p=0.894	p=0.778	p=0.426	p=0.006 (16>21)	p=0.136	p=0.771	p=0.452		
	Head of department	1048	1698	6.6	4.5	p=0.02	p=0.876	p=0.014	p=0.251	p=0.458	p=0.523	p=0.409	p=0.009 (16>21)	p=0.953	p=0.848			
	Management	1056	1678	8.4	5.5	p=0.003 (16>21)	p=0.218	p=0.146	p=0.579	p=0.565	p=0.926	p<0.0001 (16>21)	p=0.118	p=0.020	p=0.974			

Table V. — Appropriateness of the components of the Safe Surgery Checklist.

APPROPRIATENESS OF SSC COMPONENTS 2016	n participants		% appropriate		2016 vs. 2021 ANE	PROFESSIONAL GROUP			OPERATING ROOM EXPERIENCE						HOSPITAL SIZE (n beds)		
	2021	2016	2021	2016		SURG	NURSE	<1y	>1y	>5y	>10y	>20y	<200	>200	>500	>1000	
																	p=0.659
Verify ID/procedure/site	1266	1974	99.5	99.3	p=0.404	p=0.659	p=1	p=0.528	p=0.19	p=0.928	p=0.643	p=0.294	p=1	p=0.046	p=616		
Anticipated blood loss >500ml	1262	1974	63.8	68.1	p=0.012	p=0.046	p=0.179	p=0.294	p=0.004 (21>16)	p=0.032	p=0.116	p=0.818	p=0.048	p=0.654	p=0.738		
Surgical site marking	1266	1974	87.7	92.7	p<0.0001 (21>16)	p=0.027	p=0.002 (21>16)	p=0.068	p=0.052	p=0.106	p=0.003 (21>16)	p=0.008 (21>16)	p=0.149	p=0.192	p=0.223		
Allergy	1265	1974	98.0	98.6	p=0.179	p=0.102	p=0.838	p=0.491	p=0.282	p=0.052	p=0.264	p=0.077	p=0.869	p=0.192	p=0.251		
Verify anesthesia machine	1262	1974	78.4	79.1	p=0.668	p=0.602	p=0.892	p=0.554	p=0.381	p=0.001 (21>16)	p=0.268	p=0.189	p=0.342	p=0.945	p=0.743		
Verify anesthesia medication	936	1974	72.4	74.9	p=0.152	p=0.152	p=0.593	p=0.966	p=0.057	p=0.002 (21>16)	p=0.776	p=0.105	p=0.071	p=0.431	p=0.708		
Apply pulse oxymeter	1261	1974	71.5	72.5	p=0.520	p=0.772	p=0.061	p=0.828	p=0.102	p=0.042	p=0.481	p=0.169	p=0.24	p=0.92	p=0.74		
Prepare for difficult intubation	1262	1974	83.9	86.7	p=0.029	p=0.017	p=0.792	p=0.255	p=0.321	p=0.032	p=0.129	p=0.682	p=0.397	p=0.705	p=0.145		
Team introduction	1261	1974	35.9	43.9	p<0.0001 (21>16)	p<0.0001 (21>16)	p=0.016 (21>16)	p=0.693	p<0.0001 (21>16)	p=0.494	p=0.002 (21>16)	p=0.026	p=0.087	p=0.016	p=0.265		
Verify ID/procedure/site	1265	1974	94.9	96.8	p=0.008 (21>16)	p=0.303	p=0.011	p=0.747	p=0.001 (21>16)	p=0.794	p=0.567	p=0.077	p=0.696	p=0.545	p=0.027		
Antibiotics <60 min before incision	1262	1974	79.3	88.4	p<0.0001 (21>16)	p=0.001 (21>16)	p<0.0001 (21>16)	p=0.603	p<0.0001 (21>16)	p<0.0001 (21>16)	p=0.059	p<0.0001 (21>16)	p=0.018	p=0.012	p=0.001 (21>16)		
Anticipated operating time	1263	1974	53.0	58.7	p=0.002 (21>16)	p=0.102	p=0.016	p=0.928	p<0.0001 (21>16)	p=0.1	p=0.411	p=0.585	p=0.722	p=0.683	p=0.004 (21>16)		
Anticipated blood loss	1262	1974	72.3	76.1	p=0.015	p=0.064	p=0.196	p=0.893	p=0.003 (21>16)	p=0.061	p=0.147	p=0.846	p=0.333	p=0.346	p=0.018		
Anticipated problems for surgeon and anesthesiologist	1263	1974	82.0	88.2	p<0.0001 (21>16)	p=0.002 (21>16)	p=0.004 (21>16)	p=0.248	p=0.002 (21>16)	p=0.022	p<0.0001 (21>16)	p=0.264	p=0.047	p<0.0001 (21>16)	p=0.137		
Sterility confirmed	1264	1974	79.6	77.5	p=0.151	p=0.711	p=0.009 (16>21)	p=0.432	p=0.18	p=0.006 (21>16)	p=0.03	p=0.137	p=0.114	p=0.418	p=0.156		
Equipment issues	1263	1974	84.3	82.4	p=0.158	p=0.662	p=0.165	p=0.451	p=0.061	p=0.005 (21>16)	p=0.074	p=0.126	p=0.182	p=0.234	p=0.014		
Medical imaging is displayed	1265	1974	70.6	69.3	p=0.454	p<0.0001 (21>16)	p<0.0001 (21>16)	p=0.426	p=0.789	p=0.004 (21>16)	p=0.04	p=0.134	p=0.13	p=0.74	p=0.109		
Name of the procedure	1265	1974	74.5	73.0	p=0.372	p=0.62	p=0.64	p=0.84	p=0.35	p=0.334	p=0.391	p=0.036	p=0.313	p=0.553	p=0.693		
Instrument / sponge / needle count	1263	1974	95.4	96.4	p=0.182	p=0.168	p=0.017	p=0.098	p=0.19	p=0.402	p=0.939	p=0.179	p=0.178	p=0.234	p=0.28		
Specimen labelling	1266	1974	93.0	94.1	p=0.188	p=0.863	p=0.578	p=0.489	p=0.874	p=0.033	p=0.441	p=0.994	p=0.764	p=0.572	p=0.92		
Problems with equipment	1263	1974	80.9	79.7	p=0.391	p=0.573	p=0.089	p=0.73	p=0.97	p=0.111	p=0.051	p=0.328	p=0.017	p=0.496	p=0.245		
Postoperative care concerns	1264	1974	77.1	75.2	p=0.203	p=0.565	p=0.073	p=0.637	p=0.283	p=0.245	p=0.081	p=0.501	p=0.695	p=0.163	p=0.163		



Subgroup analysis confirmed that for all groups, except for staff with < 1y experience and very large hospitals, the surgeon exerted more pressure to use the SSC. More frequent peer pressure was confirmed by anesthesiologists, surgeons, staff with >5y and >20y experience and medium-sized and large hospitals. The increased pressure from anesthesiologists to use SSC was confirmed by surgeons and staff with >5y experience.

#### *Pressure to not use the checklist*

In 2021, participants found that there was significantly less pressure from hospital management and anesthesiologists to not use SSC. No significant differences were noted among the surgeons, colleagues, and department heads. Nevertheless, it is remarkable that 24% of the participants considered that surgeons would still exert negative pressure in 2021. Subgroup analysis showed a significant decrease in the pressure to not use SSC among staff with >20y experience from colleagues, management, and the head of the department. In small hospitals, the pressure exerted by department heads decreased significantly.

#### *Appropriateness of components of the SSC (Table V)*

##### *Sign In*

In 2021, significantly more participants considered surgical site marking necessary. Other components were indicated more often as necessary; however, the improvement was not statistically significant. Anticipation of blood loss is still considered the least important component by 31.9% of the participants in 2021. Asking for allergies, marking the surgical site, verifying the ID, surgical procedure, and site were considered necessary by > 90% of the participants. Subgroup analysis showed that more staff with >5y experience who considered it necessary to check the anesthesia machine and medication. More surgeons, nurses, staff in large hospitals, and staff with >10y or >20y experience considered surgical site marking necessary. More staff with >1y experience considered it necessary to anticipate blood loss.

##### *Time Out*

Despite a significant increase in 2021, the introduction of team members remains the least-supported component of SSC. Verifying the ID, surgical procedure, and site, administration of antibiotics less than 60 min before incision, anticipation of the duration of surgery, and anticipation of problems by surgeons and anesthesiologists were significantly more often considered necessary. Opinions regarding anticipation of blood loss, confirmation of sterility, equipment issues, and display of medical imaging did not change significantly. Subgroup

analysis showed significant changes between 2016 and 2021 among all professional groups, among all groups of OR experience (except < 1y), and among all hospital sizes (except for small hospitals). In 2021, fewer nurses considered the confirmation of sterility necessary.

##### *Sign Out*

For Sign Out, no significant changes were observed. The labelling of the samples and counting of compresses/needles were considered among the most important components of the SSC. Subgroup analysis showed no significant differences between the groups.

## **Discussion**

We organized this survey in all Belgian hospitals twice in the past five years, giving healthcare professionals the opportunity to express their opinions and feelings about the use of the Surgical Safety Checklist.

In the second survey, the number of participants increased significantly even though they were invited to participate in the same way. This can partly be explained by the increasing number of staff but is probably more related to the increased use of SSC, as shown in the survey (<https://www.zorg-en-gezondheid.be/ziekenhuispersoneel>). By 2021, 72.5% of the participants stated that they used SSC in more than 90% of the cases, which is clearly in contrast to 2016 when it was only 58%. This shows that SSC has become more accepted over the years, and that awareness and concern about patient safety have increased among staff. The accreditation of all Flemish hospitals and an increasing number of hospitals in Wallonia and Brussels by external organizations, with the use of SSC as an important part of the evaluation, was undoubtedly of great benefit (<https://www.zorgneticuro.be/content/accreditatie>)<sup>22</sup>. On the other hand, the five-year time lapse also ensured that use has become more established over time. A commonly made comment is that despite good compliance, the quality of completion is often insufficient<sup>23-25</sup>. As Sign In usually is executed well, Time Out and Sign Out are less well executed<sup>26,27</sup>. We did not address this in our survey.

Despite the decrease in the total number of hospital beds in Belgium since 2016, more participants were observed working in very large hospitals than in small hospitals<sup>28</sup>. The hospital mergers that have taken place in Belgium since 2016 can probably explain this (<https://www.zorgneticuro.be/nieuws/ziekenhuisfusies-oost-vlaanderen-en-limburg>).

A total of 44.7% of the participants did not know the format of the SSC (i.e., the original WHO SSC or a modified version). This shows a decline in awareness of the existence of the modified versions of the SSC. A possible explanation could be a lack of training about SSC, since several studies showed a turnover rate of hospital staff >12%<sup>29-33</sup>. A survey of (nurse) anesthetists in Germany confirmed that good training about SSC is lacking<sup>34</sup>. Owing to a lack of knowledge about the format, our research was not able to prove that most hospitals had chosen an adapted version. However, Solsky et al. confirmed in their study that all SSC were adapted<sup>35</sup>. Bergs et al. showed that many hospitals in Belgium also have an adapted version in which various components were omitted<sup>36</sup>. Knowledge of the original WHO SSC and the reason why the components were selected are important for making an adequately modified version. Without this knowledge, important components could be removed, leading to reduced patient safety. The WHO and Solsky et al. warned that important components should not be ignored<sup>35</sup>.

Concerning opinions on the use of the checklist, in 2016, most participants had already agreed with the positive aspects and disagreed with the negative ones. In 2021, more participants considered the patient's appreciation higher. Russ et al. already showed in 2014 that patients do appreciate its use<sup>37</sup>. Years later, this seems to be getting through OR professionals. Despite this appreciation, 30.7% of the participants stated that repeated ID checks were annoying. In contrast, Bergs et al. (2018) showed that patients had no difficulties with repeated identity checks<sup>38</sup>. Thus, OR professionals seem to have more problems with ID checks than patients.

Fourcade et al. showed in 2011 that the time-consuming aspect was a major problem in implementing SSC<sup>16</sup>. In the 2021 survey, the sentiment that there was too little time for SSC execution was less present, indicating that SSC is considered more important and that time is taken to execute it correctly. Moreover, a much larger proportion of the staff had negative feelings when the SSC was not completed (correctly), showing that OR professionals clearly found the use of SSC more important. Positive feelings towards the use of SSC seem to have increased over the years.

In 2021, more pressure and less resistance to SSC use was experienced. In 2016, the use of SSC was largely driven by department heads and hospital management. In 2021, we observed that pressure from physicians and colleagues to use SSC increased. This is an important fact, as several studies have shown that the hierarchy in the OR is an important barrier to implementation<sup>39,40</sup>.

Nurses often play an initiating role, which is not always easy in a strongly hierarchically regulated environment<sup>41,42</sup>. The observed change indicates that SSC is increasingly and better implemented, and that all actors agree to its usefulness.

In 2016, it was observed that there was little pressure to not use SSC. Only surgeons exerted clear pressure to avoid using SSC. Five years later, almost 25% of participants still felt pressured by surgeons to not use the SSC, confirming the findings of Verway et al.<sup>43</sup>. Arguments commonly used by surgeons are disruption of workflow, leading to OR time waste<sup>44</sup>. However, several studies have shown that there is no loss of time associated with SSC use<sup>45,46</sup>. Moreover, Anderson et al. showed that intraoperative delay occurred in 19% of surgical cases, mostly due to missing or malfunctioning equipment. Lower SSC compliance was associated with intraoperative delays<sup>47</sup>. Therefore, these arguments appear to be irrelevant.

The opinions of Belgian OR professionals regarding the appropriateness of the components of the WHO SSC have improved between 2016 and 2021. Nevertheless, not all components are supported to the same extent, explaining why SSC are often locally adapted. The most significant changes were observed in the Time Out components. At least five of the nine components were considered appropriate more frequently. Poon et al. showed that Time Out is often not performed properly<sup>27</sup>. The fact that the OR staff in Belgium considered various components more appropriate indicates that they will probably execute the SSC more accurately. The additional five years of experience may have revealed situations in which patients have benefited, which may have led to these components being regarded as more important.

The most striking observation was that the introduction of team members remained by far the least supported component. Although it improved significantly, less than 50% of participants considered this component appropriate. Hence, in many hospitals, this component is removed from the SSC. The most commonly used argument is that surgical teams in Belgian hospitals are rather small and do not often change. The team members know each other very well. However, in the largest hospitals, it is inevitable that teams are larger and change more often. In aviation, crew resource management has embraced this component and proven to be an important one<sup>48</sup>. Adopting these techniques in healthcare seems to be more difficult<sup>49</sup>. In several studies, compliance with the team member introduction component was suboptimal<sup>50,51</sup>.

## Limitations

There was no match between the answers in 2016 and 2021, because the survey was conducted anonymously. This made paired testing impossible but probably increased the reliability of the given answers because the staff was not afraid to give their own opinions.

Subgroup analysis based on region was not possible because of the different methods of data collection between 2016 and 2021. Due to differences in the methods of hospital accreditation and inspection in the different regions, a reliable subgroup analysis for this part was impossible (<https://www.health.belgium.be/en/health/taking-care-yourself/patient-related-themes/cross-border-health-care/healthcare-facility-0>)<sup>22</sup>.

## Generalizability

The target sample size for this study was achieved. Analysis by profession showed that nurses comprised the largest group and anesthesiologists the smallest group. This reflects the correct distribution of the staff in the OR. We also observed that the experience of the participating staff was equally distributed during both the study periods. These factors favor the generalizability of the study results.

## Conclusion

Five years after the first survey, SSC was used more frequently. Most opinions and feelings were positive regarding the use of SSC. Repeated identity checks remain a major topic of discussion and seem to be perceived as annoying by a large proportion of staff. The pressure from different actors to not use SSC seems to have abated. In contrast, OR staff members are often urged to perform SSC. Physicians are clearly more involved in SSC use, although we observed that most resistance to SSC use still comes from surgeons. There are still differences in opinions regarding the appropriateness of the various SSC components. Although the vast majority considered the most important components appropriate, mutual introduction of the team was not considered appropriate by the majority. Local adjustments to the SSC can ensure that the needs align with what the OR staff consider important. However, caution should be exercised, and crucial components should be maintained.

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