Why are frailty indices not used systematically during preoperative spine consultations?

¿Por qué los Índices de Fragilidad no son usados de manera sistemática en la consulta preoperatoria de Cirugía de Columna Vertebral?

¿Por que os índices de fragilidade não são usados sistematicamente durante as consultas de coluna no pré-operatório?

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Frailty indices have demonstrated to be useful in preoperative spine surgery consult in order to better discuss with patients and their families about the probabilities of having medical or mechanical complications, the length of hospital stay after the procedure or the mortality rates. However, we found that only 30% of Latin-American spine surgeons use these indices in preoperatory consultation.
This study found that the main barriers of their systematic implementation are the concepts that they all require significant time to complete, all lack validation, and all require specific instruments for score calculation.
According to available evidence, this study shows that all these reported barriers are unfounded since there is literature that refute each one of these beliefs.
As a consequence, we encourage all spine surgeons to choose a frailty index according to their necessities and to start using it systematically in their clinical practice.

Key Concepts:

- Several frailty indices have been developed to predict the probability of complications and mortality after certain surgical spine procedures.
- Higher scores are associated with more major medical complications, longer lengths of hospital stay, more mechanical complications, and higher mortality rates. However, several barriers appear to restrict spine surgeons' systematic application of these indices.
- Only 30% of spine surgeons that answered this survey claimed to use frailty indices in their routine practice.
- The main barriers limiting the extensive use of these instruments are the unfounded concepts that they all require significant time to complete, all lack validation, and all require specific instruments for score calculation.

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Abstract:

Introduction: Frailty indices are highly predictive of major medical and mechanical complications, lengths of hospital stay, and mortality rates after spine procedures. However, several barriers limit the extent to which spine surgeons employ these indices. The main purposes of the current study were to assess the use of frailty indices by Latin-American spine surgeons and identify the main barriers perceived to restrict their clinical application. **Methods:** For this cross-sectional survey, a questionnaire evaluating the demographic characteristics of participating surgeons and their utilization of frailty indices were created in Google form and sent by e-mail to every registered member of AO Spine Latin America between October and November 2020. **Results:** Of the 1047 surgeons sent the survey, 293 responded (response rate=28%). Half of the surgeons (51.7%) said they were unfamiliar with the terms ¨frailty´ and ¨frailty index¨, while 70.3% claimed not to use any frailty scale during their pre-operative assessments. The most frequently utilized index was the modified Frailty Index (mFI) (18%). The most important perceived barrier was the excessive amount of time required to calculate each patient's frailty score. Ninety-two percent of the spine surgeons felt sure that these scores could influence their therapeutic decisions, while 91% desired an easier-to-use risk-prevention scale. **Conclusion:** The main perceived barriers restricting the use of frailty indices were the time required to complete them, lack of index validation, and need for specific instruments to calculate the index score.

Keywords: frailty; spine; latin america; postoperative complications.

Resumen:

Introducción: Los índices de fragilidad aplicados a procedimientos quirúrgicos de columna vertebral, son altamente predictivos de complicaciones mecánicas y médicas mayores, de duración de estadías hospitalarias y de tasas de mortalidad. Sin embargo, existen barreras que limitan el uso extensivo de estos indices. El objetivo principal de este estudio es de evaluar el uso de Índices de fragilidad por cirujanos Latino-Americanos de Columna vertebral y de identificar las principales barreras percibidas que restringen su aplicación clínica. **Métodos:** Encuesta transversal en la cual se utilizó un cuestionario (Google Forms) enviado por correo electrónico a cada miembro registrado de AO Spine Latin-America entre octubre y noviembre de 2020. El mismo indaga las características demográficas de los cirujanos participantes y la utilización de los índices de fragilidad en su práctica clínica. **Resultados**: De los 1047 cirujanos a quienes se envió la encuesta, 293 respondieron (tasa de respuesta = 28%). La mitad de los cirujanos (51.7%) dijo no estar familiarizado con los términos "fragilidad" e "índice de fragilidad", mientras que el 70,3% afirmó no utilizar ninguna escala de fragilidad durante sus evaluaciones preoperatorias. El índice más utilizado fue el índice de fragilidad modificado (mFI) (18%). La barrera percibida más importante fue la excesiva cantidad de tiempo necesario para calcular la puntuación de fragilidad de cada paciente. El 92% de los cirujanos de columna estaban seguros de que estas puntuaciones podrían influir en sus decisiones terapéuticas, mientras que el 91% deseaba una escala de prevención de riesgos más fácil de usar. **Conclusión**: Las principales barreras percibidas que restringen el uso de índices de fragilidad fueron el tiempo requerido para completarlos, la falta de validación de los índices y la necesidad de instrumentos específicos para calcularlos.

Palabras clave: fragilidad; columna vertebral; américa latina; complicaciones posoperatorias.

Resumo:

Introdução: Os índices de fragilidade são altamente preditivos de complicações médicas e mecânicas importantes, tempo de internação hospitalar e taxas de mortalidade após procedimentos na coluna vertebral. No entanto, várias barreiras limitam a extensão em que os cirurgiões de coluna empregam esses índices. Os principais objetivos do presente estudo foram avaliar a utilização de índices de fragilidade por cirurgiões de coluna latino-americanos e identificar as principais barreiras percebidas para restringir sua aplicação clínica. **Métodos**: Para esta pesquisa transversal, um questionário avaliando as características demográficas dos cirurgiões participantes e sua utilização dos índices de fragilidade foi criado no formulário do Google e enviado por e-mail a todos os membros registrados da AO Spine Latin America entre outubro e novembro de 2020. **Resultados**: Dos 1.047 cirurgiões que enviaram a pesquisa, 293 responderam (taxa de resposta = 28%). Metade dos cirurgiões (51,7%) afirmou não conhecer os termos ¨fragilidade´ e ¨índice de fragilidade", enquanto 70,3% afirmaram não utilizar nenhuma escala de fragilidade durante as avaliações pré-operatórias. O índice mais utilizado foi o Índice de Fragilidade modificado (mFI) (18%). A barreira percebida mais importante foi a quantidade excessiva de tempo necessária para calcular a pontuação de fragilidade de cada paciente. Noventa e dois por cento dos cirurgiões de coluna tinham certeza de que essas pontuações poderiam influenciar suas decisões terapêuticas, enquanto 91% desejavam uma escala de prevenção de risco mais fácil de usar. **Conclusão**: As principais barreiras percebidas que restringem o uso dos índices de fragilidade foram o tempo necessário para completá-los, a falta de validação do índice e a necessidade de instrumentos específicos para o cálculo do escore do índice.

Palavras-chave: fragilidade; coluna; América latina; Complicações pós-operatórias.

INTRODUCTION

Frailty is defined as a medical syndrome with multiple causes characterized by progressively decreased strength, endurance, and physiological functions, which increase an individual's vulnerability to greater dependency and/or death[1]. Several frailty indices have been developed to predict the probability of complications and mortality after certain surgical procedures. The indices most commonly utilized in spine surgery patients are the modified Frailty Index (mFI)[2], the Charlson Comorbidity Index (CCI)[3], the Adult Spinal Deformity Index (ASD-FI)[4], and the Cervical Deformity Frailty Index (CD-FI)[5]. With each, higher scores are associated with more major medical complications, longer lengths of hospital stay, more mechanical complications, and higher mortality rates[2-5].

The utilization of preoperative frailty indices allows surgeons to assess elderly patients' vulnerability to untoward complications from specific spinal surgeries and provides both patients and their families with a more personalized and accurate prognosis for complications and mortality. However, several barriers appear to restrict spine surgeons' systematic application of these indices.

The purposes of the current study were (1) to assess the use of fragility indices by Latin-American spine surgeons; and (2) to identify the main barriers perceived to restrict their widespread utilization.

MATERIALS AND METHODS

Study design
This cross-sectional study was performed using a survey that was sent to every member and registered user of AO Spine Latin America (AOSLA). The questionnaire was designed to evaluate the demographic characteristics of participating spine surgeons and included specific questions regarding the utilization of frailty indices prior to spine surgery (Appendices 1A, 1B and 1C).

Frailty index survey
The questionnaire was distributed through social network media (WhatsApp groups, LinkedIn, and Facebook) and e-mailed to active AO Spine members between October and November 2020. Only surgeons who received the invitation could participate, as there was no public access to the questionnaire.

In compliance with US Federal Regulation for Institutional Review Board exemption 45 CFR 46104, once a response was accepted, it was immediately and permanently anonymized. The questionnaire was sent to 1047 surgeons using the Google Form application. All the study investigators were blinded to the identity of each responding spine surgeon. The software generated a unique network identifier (number without IP address) for every answer. A brief introduction to every question was provided, and the total time needed to complete the survey was less than 5 minutes. Answers could be sent from any available electronic device (smartphone, tablet, or computer), but each question could only be answered by the same person once due to the survey's design. The complete questionnaire is available in Appendix 1A in Spanish, Appendix 1B in Portuguese, and Appendix 1C in English.

Variables analyzed
Demographic variables studied included each respondent's sex, nationality, years of surgical experience, specialty (orthopedics or neurosurgery), hospital classification (level-1 trauma center, university-affiliated, community), number of spine surgeries performed per year by the spine surgeon, and the types of spinal pathology commonly managed. These demographic questions were followed by specific questions about the application of frailty indices during pre-surgical assessments.

Statistical Analysis
All data obtained in the survey were automatically imported into an Excel spreadsheet (Microsoft 2013, v15.0,). Both descriptive and inferential statistical analysis were performed. For the latter, since all variables were categorical, Pearson $\chi2$ analysis was employed for all univariate analyses. All two-tailed *p* values < 0.05 were considered statistically significant. All analyses were performed using Minitab18 and RStudio Version 1.1.383.

RESULTS

Out of 1047 Latin-American spine surgeons to whom the survey was sent, 293 submitted completed surveys (response rate = 28%). Of the 293 submissions, the vast majority of respondents were male (n=276; 94.2%), while 55.6% (n=163) were orthopedists versus 44.4% (n=130) neurosurgeons. Demographic and surgical practice data are summarized in **Table 1**.

Table N° 1: Demographic Data

Variable	Classification	N	Percent
Sex	Female	17	5.8
	Male	276	94.2
Country	Argentina	131	44.7
	Bolivia	5	1.7
	Chile	16	5.5
	Colombia	16	5.5
	Costa Rica	2	0.7
	Cuba	2	0.7
	Ecuador	11	3.7
	Guatemala	1	0.3
	Honduras	1	0.3
	Mexico	50	17.1
	Nicaragua	3	1.0
	Panama	2	0.7
	Paraguay	6	2.1
	Peru	20	6.8
	Dominican Republic	5	1.7
	Uruguay	3	1.0
	Venezuela	19	6.5
Specialization	Neurosurgery	130	44.4
	Orthopedist	163	55.6
Hospital level	Trauma center - level 1	27	9.2
	University-affiliated hospital	162	55.3
	Private practice	104	35.5
N of surgeries per year	< 50 per year	98	33.5
	50 - 100 per year	120	40.9
	> 100 per year	75	25.6
Pathology	Deformity	19	6.5
	Degenerative	236	80.6
	Trauma	35	11.9
	Tumors	3	1.0
Type of Practice	Urgent Surgeries	21	7.2
	Elective Surgeries	272	92.8
Patients' age	Less than 40 years	32	10.9
	Between 40 - 60 years	214	73.0
	Over 60 years	47	16.0

N = Number

Half of the surgeons surveyed (51.7%) said they were unfamiliar with the terms ¨frailty¨ and ¨frailty index¨, while 204 (70.3%) claimed not to use any frailty scale during their pre-operative patient visits **(Figure 1)**.
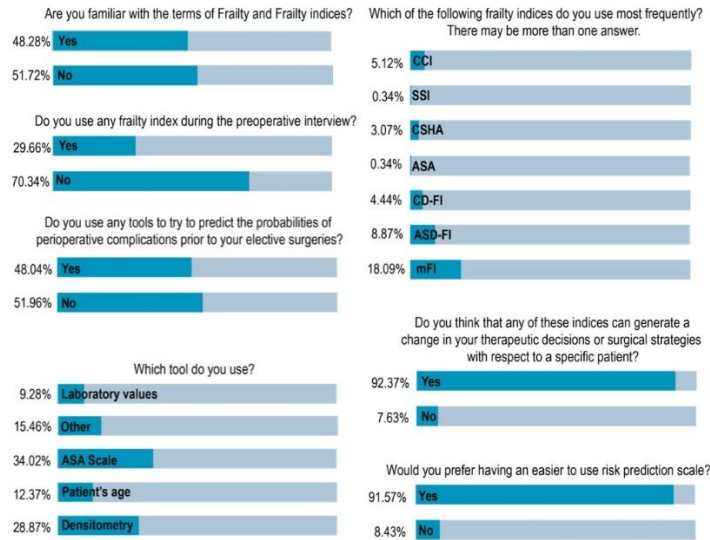

Figure N°1. Survey's results. Frailty and Frailty indices related questions. ASA = American Society of Anesthesiologists; mFI = modified Frailty Index, CCI = Charlson Comorbidity Index; ASD-FI = Adult Spinal Deformity Index; CD-FI = Cervical Deformity Frailty Index; SSI = Injury Severity Score; CSHA = Canadian Health Study of Aging and Frailty Index.

Among frailty index users, the index utilized most commonly was the mFI (n=53, 18%). Other less-frequently used frailty indices were the ASD-FI (n=26, 8.9%), the CCI (n=15, 5.2%); the CD-FI (n=13, 4.4%) and the Canadian Health Study of Aging and Frailty Index (CHSA-FI), used by just nine surgeons (3.1%) **(Figure 1)**.

Forty-eight percent (48%) of the surgeons claimed to rely on other tools to predict morbidity. Among them, the most commonly used were the American Society of Anesthesiologists (ASA) score (n=33, 34%); the patient's chronological age (n=12, 12.4%); bone mineral density (BMD) or a DEXA-scan (n=28, 29%); and various laboratory parameters (e.g., albumin serum levels, hematocrit; n=9, 9%), with 15% of surgeons reporting using "other" markers like the DRIPP ("Determinación Riesgos de Prácticas en Pacientes") score, body mass index (BMI), multidisciplinary assessment, and various combinations of these **(Figure 1)**.

The barrier against implementing these types of frailty scale that was considered most important was the excessive amount of time required for their use during pre-operative consultations, followed by the beliefs that these scales are not validated and that special software is needed to calculate the index scores **(Figure 2A)**.

The outcomes perceived as most important for these indices to predict were mortality and medical complication rate, followed by the likelihoods of reoperation, mechanical complications, and re-hospitalization (**Figure 2B**). These scores were considered more useful for surgeries like adult deformity arthrodesis, with and without posterior interbody fusions, yet less useful for procedures like anterior cervical discectomy and fusion (ACDF) or minimally-invasive spine surgery (MISS) decompression (**Figure 2C**).

Ninety-two percent (92%) of the responding Latin American spine surgeons believed that these scores could influence their therapeutic decisions and/or surgical strategies in specific patients, while 91% desired a risk prevention scale that would be easier to use (**Figure 1**). They also felt that these indices could help them decide which patients are operable and which not and, thus, decrease complication rates. Their use was considered least important for medico-legal assessments (**Figure 2 D**).
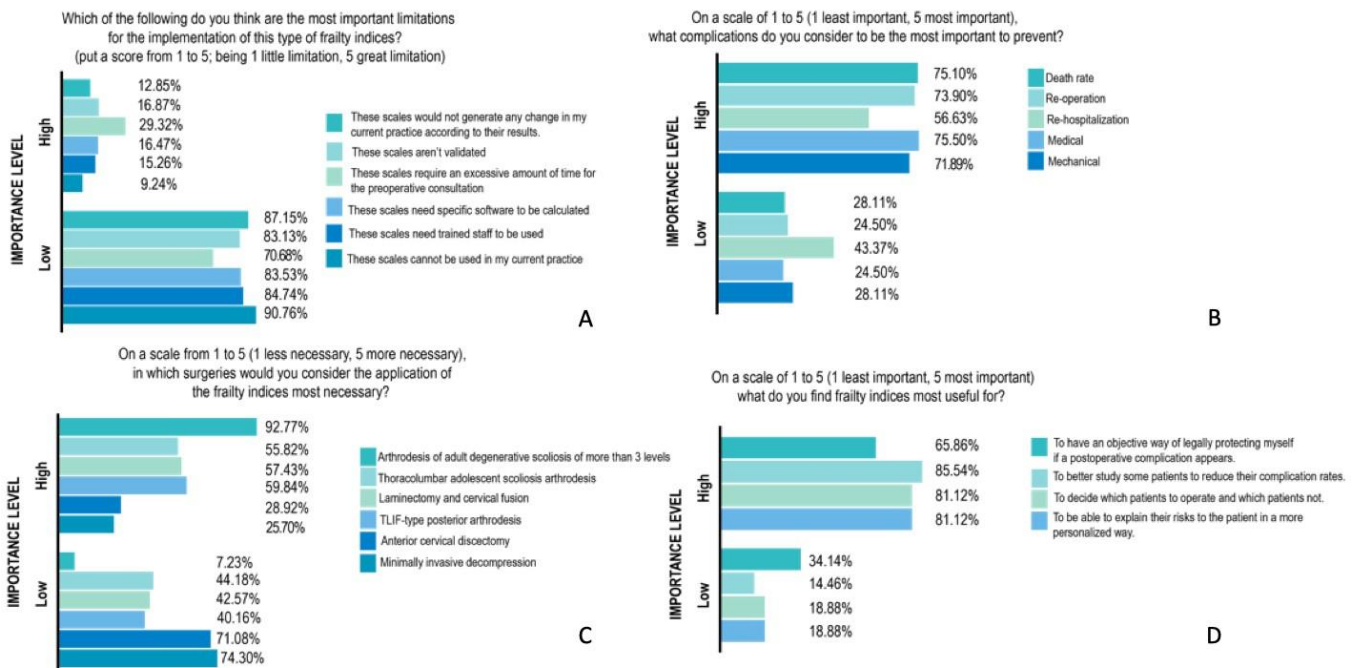

Figure N°2. A) Obstacles to frailty index implementation; B) Which types of complication are more important to predict?; C) In which type of surgery are frailty indices more applicable?; D) Frailty scores usefulness.

The analysis showed that only the number of patients a surgeon operated on correlated (inversely) with the rate of frailty index usage (**Figure 3**).
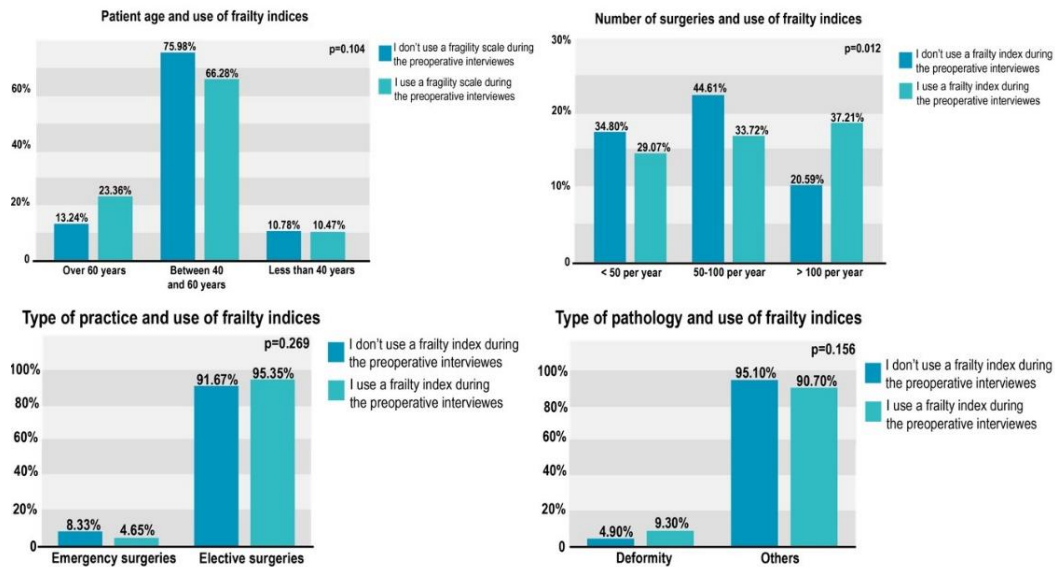

Figure N° 3. Use of Frailty indices according to patients' age, surgeons' type of practice, number of surgeries practiced annually and type of main pathology treated.

DISCUSSION

In our survey of 293 Latin-American spine surgeons, fewer than half (48.3%) were familiar with the terms ¨frailty¨ and ¨frailty index¨ and less than 1 in 3 (29.7%) claimed to use them in their daily clinical practice. On the other hand, 92% felt certain that such scores could influence their therapeutic decision-making and/or surgical strategies in specific patients. This relationship demonstrates that, despite acknowledged correlations between higher frailty index scores and several adverse outcomes — including greater mortality and complication rates and longer postoperative hospital stays after different spinal procedures[6,7] — barriers appear to prevent their widespread adoption in spine surgery practice.

Some countries, like Canada[8], Australia[9] and the United Kingdom[10], have been pioneers in the implementation of frailty screening during primary care as a national policy. Latin American countries seem to have lagged behind in this, a phenomenon confirmed by the minority of Latin American spine surgeons who answered our survey even being familiar with these terms and the sparseness of Latin American spinal literature regarding frailty index use. Urrutia et al.[11] in Chile and Pereira Duarte et al.[12] in Argentina empirically documented the utility of the APGAR score and mFI, respectively, in current practice. In Brazil, Pratali et al.[13] published a Portuguese-language adaptation of the ASD-FI endorsed by the International Spine Study Group (ISSG).

Multiple barriers to routine preoperative frailty assessments likely exist, starting with the complexity of frailty as a concept. One clear barrier related to this is the large number of heterogeneous frailty instruments described in the literature, reflecting a lack of consensus among experts in frailty assessments. For example, Aucoin et al.[14] analyzed 35 different frailty instruments in their meta-analysis. For spine surgery specifically, Varonesi et al.[15] identified 11 frailty scales implemented for degenerative and oncologic spine pathology in the last 10 years (all these indices correlated well with minor and major postoperative complications, mortality, and the length of hospital stay). Meanwhile, in their systematic review, Simcox et al.[6] concluded that four frailty indices were most often used worldwide — the mFI, ASD-FI, CD-FI, and CCI —which is consistent with our current findings.

Most of the Latin American spine surgeons we surveyed considered the amount of time required to utilize these indices as the primary barrier to their more widespread adoption. Shaw et al.[16] have similarly expressed concerns about the time consumed for screening, while Kappor et al.[17] found that the time expended during frailty scale measurements ranged from a mean 44 seconds for the Clinical Frailty Scale to 5 to 20 minutes for the Fried Phenotype. Our analysis indirectly supports the importance of this barrier, since we identified a statistically-significant inverse relationship between the number of patients a surgeon operates on annually and that surgeon's use of frailty indices. We believe that the busy schedule of spine surgery consultants in Latin America could be a factor affecting the implementation of these indices, as they are time consuming. This said, in our own experience, calculating a preoperative mFI score rarely takes longer than a few minutes, since the instrument only has 11 dichotomous questions, all answered either yes or no.

Two other perceived barriers to the widespread use of frailty indices among Latin American spine surgeons are the beliefs that these instruments are not yet properly validated, and that specific programs or software are required to calculate index scores. Upon evaluating several primary-care frailty indices, Apostolo et al.[18] concluded that only a few had been proven valid, reliable, diagnostically accurate, and reasonably able to predict complications. Among them, the Frailty Index and gait speed were considered the most useful in routine care and community settings[18]. Nevertheless, in spine surgery literature, the four most commonly used indices (mIF, ASD-FI, CD-FI and CCI) have also all been validated at different institutions, with different procedures, and in different populations[2,19]. All four employ the total number of deficits as their summation score[20], so no special programs or specialized personnel are required. Higher scores for each also have been shown to strongly predict rates of mortality and postoperative complications and the length of hospital stay[6]. As a consequence, we believe that beliefs regarding the two just-mentioned barriers are unfounded.

More than nine in ten (91%) of our survey respondents said they would prefer having an easier-to-use risk prevention scale than those currently available. Our group proposes the extended use of the mFI for all kinds of spine procedure in Latin America. The mFI employs eleven out of the 70 dichotomous variables used in the Canadian Health Study of Aging and Frailty Index (CSHA-FI)[21,22] and has a predictive value similar to that of the original score[23]. It can be calculated quickly in the office (in less than 3 minutes) without requiring trained personnel and has been validated in different studies[2,19]. A higher frailty score measured using the mFI is strongly associated with higher postoperative complication and mortality rates,

as well as longer hospital stays after all types of spinal intervention[2,3,5-7,12]. The mFI-5 (Modified 5-item Frailty Index) is the shortest version of this index currently available and has demonstrated strong correlations with complications of any kind, readmissions, and mortality following elective single- or dual- level posterior lumbar fusion[24]. This said, the published evidence supporting its use for spine procedures[25-27] is not as extensive as for the mFI.

The two aims of the current survey were to determine familiarity with and attitudes towards frailty screening among Latin American spine surgeons. Despite the limitations of this study, like the disproportionate number of respondents from Argentina, the authors believe that these findings provide new perspectives on the use of preoperative frailty indices and will help Latin American spine surgeons improve their ability to predict complication and mortality rates, relative to utilizing the ASA score or chronological age as predictive tools, since these latter two are inaccurate and lack any linear relationship with complications[28,29]. As patients age, their health deteriorates at different rates, thereby leading to significant discrepancies between chronological and physiological age as they pertain to predicting postoperative complications and mortality. It was for this reason that frailty indices were developed to assess physiological age and improve clinicians' ability to perioperatively predict post-operative adverse events. Identifying barriers and facilitators affecting the application of frailty screening should standardize and, thereby, improve the utilization of frailty indices in spine surgery patients[30].

CONCLUSIONS

In our survey of 293 Latin-American spine surgeons, only about half even were familiar with frailty indices and just 29,7% claimed to use them in their routine practice. The main barriers limiting the extensive use of these instruments are the unfounded concepts that they all require significant time to complete, all lack validation, and all require specific instruments for score calculation. We suggest incorporating the mFI as a preoperative evaluation assessment tool as it is a validated and easy-to-use tool, requires no specific tools to calculate its summation score, and only takes a few minutes to complete.

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