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EVALUATION DE LA QUALITE DES VIDEOS D'INFILTRATIONS ECHOGUIDEES DISPONIBLES SUR LES PLATEFORMES DE PARTAGE VIDEO SUR INTERNET

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LISTE DES ABREVIATIONS

EULAR : European League Against Rheumatism

GQS : Global Quality Scale

HD : High Definition

IQR : Interquartile rage

ICC : Interclass Correlation Coefficient

MOOC : Massive Open Online Course

PRP : Platelet Rich Plasma

SFCE : Société Française de Chirurgie Endoscopique

UCLA : University of California Los Angeles

UHD : Ultra High Definition

US : Ultrasound

Introduction générale

L'échographie ostéo-articulaire constitue une technique d'imagerie en plein essor notamment dans le domaine de la rhumatologie interventionnelle depuis une dizaine d'années. Véritable prolongement de la main du rhumatologue, cet outil performant bénéficie d'une évolution technologique constante avec des sondes hautes fréquences de plus en plus performantes. Nombreux sont les acteurs industriels impliqués dans ce domaine (on compte près de 102 fabricants d'échographes[1]) avec 4 entreprises qui contrôlent environ 80 % du marché de l'imagerie médicale (tout imagerie confondue) et représentant près 40 milliards d'euros de chiffre d'affaire en 2005 (dans l'ordre, l'américain General Electric Healthcare, l'allemand Siemens, le néerlandais Philips Medical Systems et, dans une moindre mesure, le japonais Toshiba) [2].

Au-delà de ces considérations économiques, l'échographie ostéo-articulaire a démontré son apport considérable dans le diagnostic et le suivi des pathologies mécaniques et inflammatoires et ses performances sont comparés à l'IRM dans certaines indications[3,4]. Son domaine d'exploration ne se limite pas à l'appareil capsulo-ligamentaire et tend à s'étendre à des structures impliquées dans des pathologies aux frontières de de la rhumatologie telle que l'échographie de nerf ou glandulaire[5].

Outil diagnostique de plus en plus indispensable au rhumatologue, l'échographie est aussi devenu un outil de rhumatologie interventionnel très maniable et performant. A la précision du geste, s'associent la facilité de mise en œuvre et l'innocuité de la technique d'imagerie basée sur des ultrasons. Elle n'est donc pas source d'irradiation. Elle ne souffre d'aucune contre-indication. Son succès tant à l'hôpital qu'en pratique courante de ville ne se dément pas et on constate une augmentation rapide et constante du nombre de rhumatologue formés à cette technique avec actuellement 3 diplômes universitaires proposant cette formation en France[6].

Le guidage échographique améliore la précision des injections par rapport au guidage anatomique même chez des médecins ayant une expérience limitée dans les infiltrations[7]. Il permet également un geste moins douloureux pour le patient et réduit le risque d'injections dans des structures nobles telles que les tendons[8, 9].
La littérature reste en revanche controversée sur la supériorité des infiltrations échoguidées par rapport à celles effectuées en repérage clinique. Une revue Cochrane n'a par exemple pas montré de manière franche la supériorité de l'échoguidage pour le guidage des infiltrations d'épaule dans les pathologies de la coiffe des rotateurs[10]. L'effet dans ce cas

pourrait aussi bien être dû à un effet systémique des corticoïdes qu'à un effet local. Ceci est à tempérer au vu de la qualité méthodologique souvent médiocre de ces études comprenant peu de patients, une pathologie souvent mal définie et des scores d'évaluation plutôt chirurgicaux. De plus, la précision de l'injection n'est jamais étudiée alors qu'une étude a montré que la précision des injections réalisées sous échographie n'est pas toujours de 100% avec seulement 70% de localisation de l'injection dans la BSAD confirmée en IRM dans une série de 23 patients injectés sous échographie[11]. Dans d'autres indications, notamment les rhumatismes inflammatoires, leur efficacité est supérieure au repérage anatomique probablement car il est important de placer les corticoïdes à l'endroit voulu pour qu'ils aient une action anti-inflammatoire optimale[12].

Malgré ces limites, il existe un champ important de développement de cette technique nécessitant la formation des médecins la pratiquant déjà ou voulant l'apprendre. Une étude réalisée en 2011 parmi les rhumatologues des pays membres de la ligue européenne contre le rhumatisme (EULAR) a montré des variations dans les techniques de formation et mis en évidence le manque de programmes de formation structurés dans la plupart des pays. Cette étude soulignait la nécessité d'harmoniser les programmes de formation et les directives (*guidelines*) même si à ce jour aucune recommandation officielle n'a pas émergé sur le plan européen[13].

Mêmes les spécialités chirurgicales, à travers la vidéochirurgie, ont beaucoup développé les formations et le partage d'expérience en ligne. La société française de chirurgie endoscopique (SFCE) propose à ses adhérents un accès en ligne à des vidéos en haute définition voir à des vidéos 3D. La technologie utilisée sur le site de la SFCE est celle du site de partage vidéo VIMEO[14].

Il existe de nombreuses méthodes pour enseigner l'échographie interventionnelle. Elle est généralement enseignée directement sur les patients sous la supervision d'un médecin expérimenté dans une logique de compagnonnage. La formation sur le sujet d'anatomie dans les laboratoires ou les instituts d'anatomie reste difficile d'accès pour l'ensemble des rhumatologues en formation du fait de leur coût et de la complexité de leur organisation. Le médecin peut également se former grâce à des livres qui proposent des voies d'abord et enseignent les principes généraux dont l'asepsie[15-18]. L'augmentation du taux de pénétration de l'internet dans les foyers, le progrès de l'informatique médicale et des technologies de l'éducation ont créé de nouvelles ressources pédagogiques parmi lesquelles le MOOC (Massive Open Online Course) [19]. Ces cours en ligne peuvent être intégrés à la formation clinique habituelle pour compléter d'autres aspects de la formation médicale[20]. Ces

enseignements en ligne pourraient trouver leur limite dans le caractère exclusivement théorique et virtuel de leur contenu ainsi que dans le coût élevé de certains d'entre eux. Une méta-analyse de Cook et al. En 2008, montre qu'en moyenne, les cours en lignes équivalaient à l'enseignement traditionnel en termes de taux de satisfaction, d'évolution des connaissances, des compétences et des comportements[21]. Dans cette optique, l'EULAR a développé un outil d'apprentissage en ligne, l'EULAR online course permettant d'acquérir des connaissances dans le domaine de l'échographie diagnostique[22] et de façon plus générale, dans les années avenir, l'enseignement des rhumatologues en formation (internes) Français se fera principalement en ligne.

Il existe enfin des sources d'information directes et peu coûteuses sur internet, notamment des plateformes de partage de vidéos telles que YouTube, Dailymotion ou Vimeo. Ces plateformes peuvent être des sources d'information pour les professionnels de la santé ainsi que pour le patient. Une plateforme de partage vidéo comme YouTube (qui est aussi un réseau social) compte plus d'un milliard d'utilisateur unique et chaque jour plusieurs centaines de million d'heures de vidéos sont publiés générant des milliards de vues[23]. Dailymotion compte près de 3 millions de visiteur unique par mois et est le premier site européen le plus visité au monde[24].

Une des méthodes pour étendre l'enseignement et la pratique des infiltrations échoguidées pourrait donc passer par une diffusion plus large des techniques, voies d'abord et bonnes pratiques par l'intermédiaire des plateformes de partage de vidéos. Cependant, les patients et les médecins ont des attentes élevées quant à la qualité des informations de santé sur internet (notamment en termes de pertinence et de fiabilité). Quelles sont la qualité, la fiabilité, la pertinence et donc la sécurité de l'information médicale disponible sur ces sites ? Nous avons mené cette étude transversale pour évaluer la qualité des ressources éducatives relative aux gestes de rhumatologie interventionnelle guidés par l'échographie et disponibles sur les plateformes de partage de vidéos les plus populaires.

QUALITATIVE ASSESSMENT OF US-GUIDED INJECTION VIDEOS PUBLISHED ON VIDEO SHARING PLATFORMS

Sofian Bourdaïm, Christelle Darrieutort-Laffite, Yves Maugars, Benoit Le Goff

Abstract

Introduction: Ultrasound (US) guided injections are becoming widespread in the treatment of rheumatic articular disorders. US allows a real time assessment of the needle progression and increase the accuracy of the injection. Video sharing platforms can be sources of information and learning material for healthcare professionals as for patients. We conducted this cross-sectional study to assess the quality of educational resources on US-guided injections published on video sharing platforms.

Method: YouTube, Dailymotion and Vimeo were searched using predefined keywords on US-guided shoulder, elbow, wrist, hand, hip, knee, ankle, foot, sacroiliac, pubic symphysis and caudal epidural injections. The videos were classified according to their source. We determined the injection site and the explanations shown for each site. We collected information on patient positioning, equipment, needle, ultrasound settings and teaching material used by the author. When demonstration was performed live in patient, the compliance with the rules of asepsis and the accuracy of the injection were evaluated. Overall, videos were evaluated for quality on a 5-point ordinal global quality scale (GQS) (from 1 = poor quality to 5 = excellent quality). Results are given as median (min-max).

Results: We found 69 979 results with the keywords. We screened 2 802 videos by titles and included 153 videos (10.05 hours). Most of videos were published on Youtube (92.2%) and 82.4% included oral explanation. 53.6% videos were published by medical advertisement or profit companies and only 9.2% videos by university, professional organization or physician group. Among the 41.2% videos showing live demonstration of injection on the patient only 25.4% followed the strict rules of asepsis. When the videos included US cineloops of injection, 10.4 % of them were outside the target. Very few videos gave details about information on the pathophysiology of the disease (6.5%), the risk (0.7%), the benefice (11.2%) or the products used for the injection (58.2%). Overall, 3.3% of the videos were classified as “Excellent quality” on the GQS, 24.2% as “Good quality”, 23.5% as “Moderate quality”, 34.6% as “Generally poor quality” and 14,4% “Poor quality”. We compared the characteristics of the good quality videos (GQS score ≥ 4) versus the one rated ≤3. Better quality videos were longer (1.3 min ((0.07-1.05) versus 3.62 (0.32-40.43) min), had oral explanation (95% versus 77%; p=0.008). They more frequently showed the clinical and US site of injection and accurately reached their target (90% versus 68%). They

were significantly more viewed (m2719 (13-80195) versus 856 (11-60174); p=0.026) and more liked (1 (0-80) versus 7 (0-58) (p=0.002)). However, some poor quality videos had more than 60 000 views. Quality of the video created by medical advertisement or profit companies were not different from those coming from university but significantly better than those from individual physician or with unknown origin (p=0.011).

Conclusion: Our study reveals a generally a low quality of US guided learning videos available on the most popular video sharing platforms. We observed a lack of information on the treatment, its risks and benefits. Institutional videos are unfortunately rare on internet although video released by private companies were overall of good quality. Strict aseptic techniques are rarely followed and the injection can be outside the target. Finally, we identified characteristics associated with the quality of the video that can be used to improve their educational impact in the future.

Introduction

Ultrasound (US) guided injections are becoming widespread in the treatment of rheumatic articular disorders. US is an accurate method to perform diagnostic studies and to evaluate both morphology and function by means of dynamic evaluations[3,4]. Different pathological conditions can be diagnosed using US and treated using US guidance injection, such as degenerative, traumatic or inflammatory diseases. A study realised in 2011 among rheumatologists in the member countries of the European League Against Rheumatism (EULAR) showed important variations in practice, the lack of available structured training programmes for trainees in most countries and indicated the need for standardization in areas including training guidelines[13].

There are many methods available to teach interventional procedures. They are usually taught directly on patients on the supervision of experimented physician. Training on cadaver in anatomy laboratories remains difficult to provide to all the trainees because expansive and complex in their organization. Steady expansion in Internet penetration rates and advances in Health Informatics and educational technology have created new teaching resources among which the MOOC (Massive Open Online Course) are the most popular[19]. These courses can be integrated into traditional clinical course to complement other aspects of the training[20]. The limits of this type of teaching are that they do not cover all the aspect of medical education and some of them remain expensive. Cook et al.'s 2008 meta-analysis addressed efficacy showed that, on average, Internet formats were equivalent to non-Internet formats in terms of learner satisfaction and changes in knowledge, skills and behaviour [21].

Some video sharing platforms such as YouTube, Dailymotion or Vimeo can also be used as sources of information for healthcare professional as well as for the patient. Video sharing platform like YouTube has more than 1 billion users and everyday people watch hundreds of millions of hours and generate billion of views[23]. Dailymotion has 3 hundred million visitors by month and is the first European site most visited in the world[24]. Patients and physicians have high expectations of the value and quality of health information websites (especially in terms of reliability and relevance). However, what are the quality, reliability, relevance, and therefore the security of information available on these sites? We conducted this cross-sectional study to assess the quality of educational resources available on the most popular video sharing platforms on US guided injection technics.

Methods

Selection of the videos (Figure 1)

The terms “ultrasound guided shoulder injection”, “ultrasound guided elbow injection”, “ultrasound guided wrist injection”, “ultrasound guided hand injection”, “ultrasound guided hip Injection”, “ultrasound guided knee injection”, “ultrasound guided ankle injection”, “ultrasound guided foot injection”, “ultrasound guided sacroiliac injection”, “ultrasound guided caudal epidural injection” and “ultrasound guided pubic symphysis injection”, were searched in YouTube, Dailymotion and Vimeo between July 4, 2015 and June 30, 2016. The computer history and cookies were deleted before search in order to not influence the search results. The search returned 69 979 video results. Given the low probability for users to go beyond the first pages of any search results, only the first 200 titles were further analyzed. One evaluator first screened 2 802 videos according to their title. We included only the videos that showed a demonstration or an explanation of the US-guided injection technic. Only English and French videos were reviewed. The video was excluded if it was off topic.

Assessment of video characteristics, measure of viewer interaction,

Basic information on each video were collected: video name, author, publisher and his qualification, URL, search rank, YouTube publicly reports measures of views, “likes” and “dislikes”. We recorded the date of upload, video length, maximal resolution (240p, 480p, 720pHD, 1080pHD, 2 160pUHD), total viewership and duration of time on the site.

Source of upload and target audience

Videos were classified into four categories based on source:
A: government/university/professional-organizations/physician-groups/news agencies, B: medical-advertisements/for-profit-companies, C: individual physician, and D: unknown.
We categorized the target audiences into 3 groups: health care professional, patients, and target audience unspecified.

Assessment of pathology information

We evaluate if each video contains scientifically accurate information on epidemiology, pathogenesis, symptoms, complications and prevention and lifestyle modifications. We

recorded the pharmacologic treatment used. This information was noted present or absent (Yes or No).

Assessment of the injection technique and accuracy

We determined the injection site (glenohumeral joint, subacromial bursa, acromioclavicular joint, head of biceps tendon sheath for the shoulder or radiocarpal joint, finger flexor sheath, De Quervain's tenosynovitis or carpal tunel for the wrist and the hand, etc.), the number of route of injection shown, the position of the probe relative to limb and of the needle relative to probe. We collected information on patient positioning, equipment, needle, and ultrasound settings.

When demonstration was performed live in patient, we recorded (Yes or Not): Description of the local anatomy, Clinical location of the injection site, Description of the anatomical relationships in the ultrasound image, Ultrasound location of the injection site, Viewing of the progression of the needle.

When injections were performed on patients, we evaluated the compliance with the rules of antisepsis (Yes or Not): probe protection (sterile, plastic and disposable), distance between probe and needle 1 cm (at least), use of skin antiseptic and wearing gloves.

When live US guided movie were available, the accuracy of the injection was evaluated on a 3-point scale based on the location of the injection: (1) inaccurate, (2) partially accurate and (3) accurate.

Finally, the videos have been classified according to their technical solutions of the demonstration in 3 groups: 'Patients group' (demonstration in real patients with ultrasound images only or along with mannequins or diagrams), 'Ultrasound images group' (ultrasound images only or along with mannequins or diagrams) and 'Mannequin group' (mannequin and/or diagram and/or oral explanation without US image or movie).

Assessment of global quality and reliability

We used several element of the Discern Tool, which is an instrument for judging the quality of written health information[25]. It was funded by the British Library and de NHS Research and development program. It established quality criteria for consumer health information on treatment choice. We adapted it to the US-guided injection techniques. We appraised the

video reliability (8 questions), the quality of information on US-guided injection technique choices (7 questions) and one overall quality rating of the video. Each question is rated on a 5-point scale ranging from No to Yes:

1) Are the aims clear?
2) Does it achieve its aims?
3) Is it relevant?
4) Is it clear what sources of information were used to produce *this video* (other than the author or producer)?
5) Is it clear when the information used or reported in the publication was produced?
6) Is it balanced or unbiased?
7) Does it provide details of additional sources of support and information?
8) Does it refer to areas of uncertainty?
9) Does it describe how each *US-guided injection techniques* and treatment works?
10) Does it describe de benefit of each *US-guided injection techniques* and treatment?
11) Does it describe the risks of each *US-guided injection techniques* and treatment?
12) Does it describe what would happen if no *US-guided injection techniques* and treatment is used?
13) Does it describe how the *US-guided injection techniques* and treatment choices affect overall quality of life?
14) Is it clear that there may be more than one possible *US-guided injection techniques* or treatment choice?
15) Does it provide support for shared decision-making?
16) Based on the answers to all of the above question, rate the overall quality of the publication as a source information about *US-guided injection techniques.*

Finally, a subjective global quality score was also assigned to each video, based on the work of Bernard et al. who developed an evaluation tool for website resources using a 5-point scale which assesses flow, ease of video use, and quality of video[26]. We graded on a five point ordinal scale based on following criteria:

1) Poor quality, poor flow of the video, most information missing, not at all useful for practitioner.
2) Generally poor quality and poor flow, some information listed but many important topics missing, of very limited use to practitioner.
3) Moderate quality, suboptimal flow, some important information is adequately discussed but other poorly discussed, somewhat useful for practitioner.
4) Good quality and generally good flow, most of the relevant information is listed, but some topics not covered, useful for practitioner.

5) Excellent quality and excellent flow, very useful for practitioner.

Statistical analysis

Descriptive statistics for continuous variables were expressed as mean (+/-) standard deviation for normally distributed variables and median and interquartile range (IQR) for skewed variables. Categorical variables were expressed as proportions or percentages. Differences in categorical variables were assessed using the X^2 test. Differences in continuous variables were assessed using the t-test or the Mann-Whitney test as appropriate. A *p* value of ≤ 0.05 was considered significant. The interobserver difference in reliability and quality score for a sample of 38 videos were calculated with the interclass correlation coefficient (ICC). Statistical analysis was conducted using the SPSS statistical software.

Results

Characteristic of the video (Table 1)

We screened 2 802 video titles and 153 videos were finally included in our analysis (Figure 1). Cumulative time of the videos was 10 hours 3 minutes. Ninety-two percent of included videos came from YouTube, 82% were in English and 18% had no comments. Duration of the video was a median 1.8 minutes (0.07-40.03; IQR (3.03)). Most of the video's resolution was more than 480p (127; 83%) and 61 (40%) were in high definition (720pHD, 1 080pHD and 2 160pUHD).

Median publication date was 1 282 days (214-2 766; IQR 734) with a peak of publication in 2012 and 2013 (respectively n=34 and n=35) and a stabilisation in 2014 (n=27) (Figure 2). The combined number of views for all videos was 1 066 035 with a median number of views for each video of 1 021 (11-80 195; IQR (7 766)).

One hundred and forty-one videos (92.2%) received at least one like by viewer with 5 outliers: on ultrasound guided sacroiliac joint injection by Sonosite (80 195 views; 53 likes), on PRP ultrasound guided injection of the hip by the University of California Los Angeles (UCLA) (60 174 views; 56 likes), on PRP ultrasound-guided injection of the knee by UCLA (55 841 views; 59 likes), on ultrasound guided hip Injection by SonoSite (54 165 views; 32 like) and on PRP ultrasound guided injection of the shoulder by UCLA (52 237 views; 52 likes). Most of the videos (n=110; 72%) had less than 5000 views. We found a significant correlation between the number of view and the liked status ($p<0.0001$; $r=0.708$) (Table1, Figure 3).

Source of the video was medical-advertisements/for-profit-companies in 82 cases (53.6%), individual physician in 41 cases (26.8%), government/news agencies, university/professional-organizations or physician-groups in 14 cases (9.2%), and unknown in 16 cases (10.5%). One hundred twenty two videos (79.7%) targeted health care professional. Sixteen videos (10.5%) targeted patients. Fifteen videos (9.8%) had no apparent target audience.

Pharmacologic treatment was used in 126 videos (82.4%). Concerning injected substances, corticosteroid was used in 32 cases (36%) and Platelet-Rich Plasma (PRP) in 16 cases (Table 1).

Assessment of information on disease (Table 2)

Four videos (2.6%) contain information on epidemiology. Twenty videos (13.1%) discussed on pathogenesis. Ten videos (6.5%) described symptoms. One video (0.7%) described complication of the disease. Two videos (1.3%) evoked prevention and lifestyle modifications.

The Discern Tool is an instrument for judging the quality of written health information. Evaluation of the quality of the videos is summarized in table 9.

Overall, videos scored higher for questions relative to the aim, relevance and achieved their aim. On the opposite, quality was poor for questions relative to the information on disease (source, date and support, areas of uncertainty) and US-guided injection techniques (how it works, the benefit, the risk). As the aim of the videos was to teach US-guided injection techniques and the information on the disease, the overall quality of the publication still obtained a median score of 3 (1-5; IQR 2) (Table 2).

Assessment of the injection

Twenty-seven different injection locations were shown in the videos and ate listed in Table 4. Sixty-two (40.5%) were on the upper limb, 81 (53%) on the lower limb and 10 (6.5%) on other locations. Intra-articular knee injection was the first site with 35 videos (22.9%). Hip joint injection was described in 27 videos (17.6%) and subacromial bursa injection in 15 videos (9.8%). Two videos (1.3%) do not present any injection location. (Table 4)

Seventy-three (47.7%) and 78 (51%) of the videos described the local anatomy and the clinical location of the needle entrance respectively. Seventy-seven (50.3%) of the videos described anatomical structures adjacent to injection site on ultrasound images. Eighty-nine (58.2%) showed US location of injection site. One hundred (65.4%) showed needle progression and injection on live US movie respectively. The others explained the principles and the route/target of injection.

Median number of injection routes was 1 (1-6; IQR 0). One hundred forty videos (91.5%) showed 1 route and 6 videos (3.9) showed 2 routes. Only one video (0.7%) showed 6 injection routes. Six videos (3.9%) did not present any injection route. Patient positioning was explained or clearly visible in 82 videos (53.6%). Probe positioning relative to limb was transversal in 86 cases (58.5%), longitudinal in 58 cases (39.5%) and both in 3 cases (2%).

Technical solutions for demonstration were an injection in a real patient, showing the site and route of injection with a live ultrasound injection in 57 cases (37.3%) (Table 3). Some videos showed the site of injection on a patient without puncture in parallel with a moving image of ultrasound injection in 32 cases (20.9%). Videos showed only animated ultrasound images in 28 cases (18.3%).

We studied the injection aseptic technique when a real injection was performed on real patients (57 videos). Physician was wearing gloves in 34 videos (60%), showed a disinfection of the skin in 28 videos (49%) and was more than 1 cm from the probe in 26 videos (46%). Probe protection was used in 10 videos only (18%). These 4 elements have been associated in only 7 videos (12%) (Table 5). The assessment of accuracy of the injection shows that overall 10.5% of the injections were performed outside the target, 15% were partially accurate and 74.5% were accurate.

Global quality of the video (Table 6)

We assessed the quality of the video using the discern tool and the Global Quality Scale (GQS) performed by two independent observers (BLG; SB). The interobserver reliability was good (ICC 0.691 (95% IC 0.471-0.828) for the GQS on a sample of 38 videos.

Quality of the videos was rated as followed: 5 (3.3%) videos were considered as excellent quality; 37 (24.2%) good quality; 36 (23.5%) moderate quality; 53 (34.6%) generally poor quality and 22 (14.4%) poor quality. When considering video with GCS more or equal to 4, only 42 (27.5%) were considered as good quality videos

Factors associated with the quality of the videos (Table 7)

We next compared the characteristics of the video between the videos with GCS more or equal to 4 to the one rated less than 3 on this scale. The length of the video was significantly higher in the good quality group (3.62 versus 1.3 minutes respectively, $p<0.0001$). Good quality group was significantly more commented (95.3% versus 77.3%, $p = 0.008$). Number of view median was significantly more important in good quality group (2719 versus 856, $p=0.026$). Number of subscriber median was significantly more important in good quality group (427 versus 109.5, $p<0.0001$). There were significantly more videos from unknown source in the poor quality group (13.6% versus 2.3%, $p=0.041$). We only found a trend in favor of a more represented medical advertisement and profit companies video (62.1% versus 49.1%, $p=0.066$), more represented institutional video (16.3% versus 6.4%, $p=0.053$)

in good quality video and a trend in favor of a more represented individual physician video in poor quality group (30.9 versus 16.3%, p=0.07). Videos with medical target audience were more represented in good quality group (93% versus 74.5%, p=0.036).

The videos showing patient positioning were more represented in the good quality group (72.1% versus 46.4%, p=0.004). The videos showing clinical location of the needle entrance, local anatomical description, US scan description and target US point, were also more frequent in the videos considered as good quality (p<0.0001 for each). We found significantly more accurate injection in the good quality group (90.3% versus 68%, p=0.045).

No significant difference was found according to the technical solution used for the demonstration. None of the other characteristics of the video was significantly different between the two groups notably the injection site, the compliance with all aseptic rules and US-setting.

Discussion

Training in musculoskeletal US and US-guided injection is considered by many to be a virtually endless process. There is currently no agreement between recognised experts on the best approach to adopt to teach it. In recent years, several proposals have been put forward with the aim of addressing the specific difficulties encountered by rheumatologists training in US and US guided procedures. US training in rheumatology should ideally include the full immersion program of normal anatomy and histopathology of rheumatic diseases, high quality US equipment, continuous interaction with an experienced tutor and time devoted to the practice of US. Direct supervision by an expert (mentor) is universally recognised as a core element for appropriate training in US[27]. Unfortunately, this approach is beset with logistical difficulties in terms of the relative lack of recognised tutors together with constraints on time for both tutor and student. The percentage of rheumatologists receiving specific training in echo-guided gestures is low, less than 10% in a 2012 study in 44 EULAR member countries. Thus development of Internet based learning could be an opportunity for physician to learn US guided injection. We performed this study to assess the quality of the resources already available on Internet to learn US guided injection of the shoulder.

We first assessed the origin of the video. We observed that only 9.2% of the video came from government/university/professional-organizations or physician-groups that, in theory, might guarantee quality and reliability of the information. The main sources of video came from US manufacturers. Companies already strongly involved in medical training through symposium, medical equipment financing and research project are investing heavily in the internet. Independent physician posted three of the 5 most viewed videos. These videos were also the most “liked” by the viewers. Interestingly we found trends towards a better video quality in video coming from institutional sources or profit companies whereas videos from individual physician or of unknown origin were considered as less good. This shows that, even if conflicts of interest can represent a risk in the development of teaching material by private companies, they are the main source of teaching material on US-guided injection with good quality contents. The price of production of such videos might explain this result.

The Discern Tool is an instrument for judging the quality of written health information. It has been adapted in our study to assess the information on a teaching video. We found that the videos scored low on the information related to the disease. Teaching US-guided injection should not only deal with its technical aspect but also with all the steps needed before and after the injection. Firstly, information on the disease, its treatment, and the efficacy of the injection should be mentioned. Then, contraindications to the injection must be screened

before the injection. Lastly, it is important to inform the patients on the risks of infection and pain after the procedure. Although these videos are dedicated to some experienced practitioners that may be aware of all those steps, they are freely available to all viewers and should be comprehensive enough to give minimal information on all the points mentioned above.

We noted that the most popular videos concerned the use of PRP. Despite a lack of consensus regarding PRP indications and efficacy, we observed widespread application of this treatment for various musculoskeletal injuries like tendon and ligament tears, cartilage damage, and bone fractures. PRP is a blood product that allows in a simple, low cost, and minimally invasive way to obtain a concentration of many of growth factors and biologically active molecules. Studies have evaluated the use of PRP in many indications, especially in knee osteoarthritis, plantar fasciitis, Achilles tendinopathy, rotator cuff repair and elbow tendinitis with no definite proof of their efficacy. None of the videos mentioned these areas of uncertainty. Moreover, the videos did not describe the methods of producing PRP.
There are 5 injectable corticosteroids that have a current Food and Drug Administration (FDA) label for IA injections. These consist of methylprednisolone acetate, triamcinolone acetate, betamethasone acetate and betamethasone sodium phosphate, triamcinolone hexacetonide, and dexamethasone. Efficiency of corticosteroid injection depends of correct indication, dosage, timing, and application. The videos did not give any details about the injectable corticosteroid available on the market, their respective indication, their contraindication, and their undesirable effects. The videos did not mention precaution of employment.

We next tried to assess the characteristics of good quality videos. First, we found that these videos were longer. Most of the video we found was less than 2 minutes and consists of short US moving images only showing the route of injection. These types of videos are not long enough to deal with other important teaching aspect of the injection. Indeed, it is important to have comprehensive explanations on the local anatomy, site of injection and the final target. This basic information was absent in most videos. We found a significant correlation between the “liked” status and the quality of the content. Our results contrast with the finding of Kumar et al. who stud the quality of internet resources on hypertension and found that viewer engagement (number of views and “liked” status) was a poor predictor of usefulness and/or content[28]. This difference could be explained by the fact that the content they studied was dedicated to patients’ information and not physician education. Surprisingly, demonstration on patients was not associated with the quality. They were only a trend in favour of the use of virtual models. These show that the most important information might be

taught without performing injection on patients. However, different modes of course delivery might suit different learners in different contexts and assessment of video quality by student more than by teacher could be another way to assess the quality of the video contents.

The scarcity of information on the basics of ultrasound suggests that these videos are targeting a confirmed public. We did not find information on important topics such as US-orientated anatomy, physics and main findings of US in rheumatology, ability to evaluate the US findings in the clinical setting, basic knowledge of color and/or power Doppler technique (especially important to avoid vascular or nervous complications) and equipment basic technical knowledge of the US equipment.

There is currently no consensus on the best protocol to use in order to decrease the risk of iatrogenic infection after US-guided injections[29]. Some believe that the use of US to guide musculoskeletal injections might increases this risk because of the proximity of the needle and the probe and the multiple steps needed to perform an injection. There is currently no data to confirm this hypothesis and the rarity of such complication makes its risk hard to evaluate. The rate of iatrogenic osteoarticular infection in interventional rheumatology is very low. The French series find extremely low rates between 0.15 and 0.26 per thousand[30,31,32]. In the videos we studied, the procedures were mostly performed without gloves. A sterile cap protected rarely the probes and the distance between the needle and the probe was often less than 1 centimetre. SIRIS (rheumatology and imaging section of the French Society of Rheumatology) recently published expert opinions on this topic taking in account the literature and the current practice of their members. They emphasized the need of good condition for performing an ultrasound-guided procedure: hand hygiene, wearing gloves, wearing a facial mask. However, in the absence of available evidence based medicine, longitudinal cohort studies including thousands of US-guided injected patients will be necessary in the future to answer the real risk of such complication.

Our study has several limitations. The sample video was not sufficiently large to make further extrapolations to predict several factors associated with video quality. We could not assess the exact nature of the audience watching these videos. We hypothesize an exclusively medical audience without being able to prove it. The videos were exclusively from YouTube, which seems to monopolize the user queries on the subject. More and more videos are broadcast through social networks we have not studied. Data on the settings of the ultrasound equipment was unfortunately not available.

Overall, our study shows a generally low quality medical content available on the most popular video sharing platforms. Ultrasound manufacturers and private companies were the first in the provision of easily accessible and free information. We noticed a lack of information on treatment type, its benefits and risks. Institutional videos, independent and reliable sources were unfortunately rare on this type of site. Aseptic conditions were rarely observed and the injection was sometimes performed outside the target. Other studies evaluating YouTube content on medical topics such as arterial hypertension, rheumatoid arthritis, cardiopulmonary resuscitation, kidney stones, anorexia nervosa, and H1N1 influenza have all pointed toward a considerable heterogeneity in the quality of information and the scarcity of useful and qualitative videos for patients as for physicians[33-37]. Although free videos available on Internet might be a way to help physician to improve their technical skills, there is a clear need to standardize their quality and educational contents.

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TABLES

Table 1: Viewership of videos

Variables				
Sites	Youtube	Dailymotion	Vimeo	Total
Total number of videos offered by the site for all keywords	40108	29865	6	69979
Total number of videos selected for analysis (taking the first 200 results for each keyword group)	2802			
Number of videos included according to the criteria of relevance to their title.	141	10	2	153
Number of liked videos n(%)	96 (63%)	-	-	-
Number of likes median (min-max;IQR)	3 (0-80;IQR 10)	-	-	-
Number of dyslikes median (min-max; IQR)	0 (0-23;IQR 1)	-	-	-
Cumulative videos time (hour)	10.05			
Langage n(%)				
English	126 (82%)			
Unknown or no comment	27 (18%)			
Maximal resolution for each video n(%)				
240p	14 (9.2%)			
360p	12 (7.8%)			
480p	66 (43.1%)			
720p (HD)	38 (24.8%)			
1080p (HD)	20 (13.1%)			
2160p (UHD)	3 (2%)			
Duration in minutes Median (min-max;IQR)	1.8 (0.07-40.43;IQR(3.03))			
Number of days online Median (min-max;IQR)	1282 (214-2 766;IQR(734))			
Cumulative number of views	1 066 035			
Videos with less than 5000 views n(%)	110 (72%)			
Median number of view for each video (min-max;IQR)	1021 (11-80 195;IQR(7 766)			
Source n(%)				
Government/news agencies, university/professional organizations/physician-groups	14 (9.2%)			
Medical-advertisements/for-profit-companies	82 (53.6%)			
Individual physician	41 (26.8%)			
Unknown	16 (10.5%)			
Target audience n(%)				
Health Care Professional	122 (79.7%)			
Patients	16 (10.5%)			
Both	15 (9.8%)			
Videos showing substance injection	89 (58.2%)			
Corticosteroid	32 (36%)			
Platelet-Rich Plasma (PRP)	16 (18%)			
Cortosteroid and anesthetic	6 (6.7%)			
Sodium haluronate	5 (5.6%)			
Anesthetic	1 (1.1%)			
PRP and anesthetic	1 (1.1%)			
Ozone	1 (1.1%)			
No identified substance	26 (29.2%)			

(IQR : Interquartile range)

Table 2: Video quality evaluation with Discern tool and assessment of pathology information

Discern questions (Score greater than or equal to 4)	n (%)
1. Are the aims clear?	121 (80%)
2. Does it achieve its aims?	125 (82%)
3. Is it relevant?	84 (55%)
4. Is it clear what sources of information were used to produce this video?	2 (1.3%)
5. Is it clear when the information used or reported in the publication was produced?	3 (2%)
6. Is it balanced or unbiased?	95 (62%)
7. Does it provide details of additional sources of support and information?	1 (0.7%)
8. Does it refer to areas of uncertainty?	3 (2%)
9. Does it describe how each US-guided injection techniques and treatment works?	3 (2%)
10. Does it describe de benefit of each US-guided injection techniques and treatment?	6 (4%)
11. Does it describe the risks of each US-guided injection techniques and treatment?	3 (2%)
12. Does it describe what would happen if no US-guided injection techniques and treatment is used?	3 (2%)
13. Does it describe how the US-guided injection techniques and treatment choices affect overall quality of life?	4 (2.7%)
14. Is it clear that there may be more than one possible US-guided injection techniques or treatment choice?	4 (2.7%)
15. Does it provide support for shared decision-making?	4 (2.7%)
Based on the answers to all of the above question, rate the overall quality of the publication as a source information about US-guided injection techniques Median (min-max;IQR)	3 (1-5; IQR 2)
Assessment of pathology information	**n (%)**
Epidemiology	4 (2.6%)
Pathogenesis	20 (13.1%)
Symptoms	10 (6.5 %)
Complication of the pathology	1 (0.7%)
Prevention and lifestyle modifications	2 (1.3%)
Use of pharmacologic treatment	126 (82.4%)

(IQR : Interquartile range)

Table 3: Technical solution and the development of the demonstration

Variables	
Median number of injection pathway (min-max;IQR)	1 (1-6;IQR 0)
One injection pathway n(%)	140 (91.5%)
Two injection pathway n(%)	6 (3.9%)
Other n(%)	6 (3.9%)
Patient positioning n(%)	82 (53.6%)
Probe positionning relative to limb n(%)	
Transversal approach	86 (58.5%)
Longitudinal approach	58 (39.5%)
The both	3 (2%)
Technical solutions for demonstration n(%)	
Simultaneous use of a patient and an ultrasound image for demonstration	57 (37.3%)
Patient video without gesture and visible infiltration on a moving US-image	32 (20.9%)
Only animated ultrasound images	28 (18.3%)
Only mannequins or diagrams	14 (9.2%)
Only oral description	12 (7.8%)
Demonstration on a real patient, a mannequin or a diagram and a simultaneous US-video	6 (3.9%)
Virtual model or schema, and animated images of ultrasound	4 (2.6%)
Description of the local anatomy n(%)	73 (47.7%)
Clinical location of the needle entrance n(%)	78 (51%)
Description of the anatomical relation in the ultrasound image n(%)	77 (50.3%)
US location of the injection site n(%)	89 (58.2%)
Viewing of needle progression and injection n(%)	100 (65.4%)
Videos showing US settings n(%)	12 (12.8%)

(IQR : Interquartile range)

Table 4: Location of injection

Location	n (%)
Upper limb	62 (40.5%)
Subacromial bursa	15 (9.8%)
Glenohumeral joint	10 (6.5%)
Biceps tendon sheath	9 (5.9%)
Acromioclavicular joint	7 (4.6%)
Carpal tunnel	5 (3.3%)
Pectoralis tendon	4 (2.6%)
De Quervain's tenosynovitis	3 (2%)
Carpometacarpal articulation thumb	3 (2%)
Radiocarpal joint	2 (1.3%)
Finger flexor sheath	2 (1.3%)
Lateral epicondylitis	1 (0.7%)
Medial epicondylitis	1 (0.7%)
Lower limb	81 (53%)
Knee joint	35 (22.9%)
Hip joint	27 (17.6%)
Talocrural joint	3 (2%)
Heel spur	3 (2%)
Plantar fasciitis	3 (2%)
Retrocalcaneal bursitis	2 (1.3%)
Tibialis posterior tendon sheath	2 (1.3%)
Metatarsophalangeal joint	2 (1.3%)
Popliteal cyst	1 (0.7%)
Knee medial collateral ligament	1 (0.7%)
Psoas bursa	1 (0.7%)
Peritronchanteric bursitis	1 (0.7%)
Other	10 (6.5%)
Sacroiliac joint	6 (3.9%)
Pubic symphysis	1 (0.7%)
Caudal epidural	1 (0.7%)
No injection location	2 (1.3%)

Table 5: Compliance with aseptic rules

Variables	n (%)
Videos with real injection performed on real patient	57 (37%)
Probe protection	10 (18%)
Distance probe/needle to over 1 centimeter	26 (46%)
Skin antispesis	28 (49%)
Gloves wearing	34 (60%)
Compliance with all aseptic rules	7 (12%)
Videos with US-images of injection	106 (69.3%)
Injection accuracy	
Accurate	79 (74.5%)
Partially acurate	16 (15%)
Inaccurate	11 (10.5%)

Table 6: Videos Global Quality Score (GQS)

Variables	
ICC (GQS interobserver reliability)	0.691 (95% IC 0.471-0.828)
Global Quality Score mean n(%)	
Excellent quality and excellent flow, very useful for practitioner	5 (3.3%)
Good quality and generally good flow, most of the relevant information is listed, but some topics not covered, useful for practitioner	37 (24.2%)
Moderate quality, suboptimal flow, some important information is adequately discussed but other poorly discussed, somewhat useful for practitioner	36 (23.5%)
Generally poor quality and poor flow, some information listed but many important topics missing, of very limited use to practitioner	53 (34.6%)
Poor quality, poor flow of the video, most information missing, not at all useful for practitioner	22 (14.4 %)

(ICC: Interclass Correlation Coefficient)

Table 7: Content analysis of all videos

Variables	Poor quality videos 111 (72.5%)	Good quality videos 43 (27.5%)	*P* value
Original website n(%)	102 (92%) YouTube	39 (90%) YouTube	0,81
Order of appearance Median (min-max) IQR	41.5 (1-199) 79	26 (1-199) 79	0.109
Duration (min) Median (min-max) IQR	1.3 (0.07-1.05) 2.64	3.62 (0.32-40.43) 8.78	<0.0001
Language in commented videos n(%)	85 (77.3%)	41 (95.3%)	0.008
Publication date (day) Median (min-max) IQR	1 180 (214-2 766) 726	1 461 (433-2 684) 1 079	0.15
Number of view Median (min-max) IQR	856 (11-60 174) 6229	2 719 (13-80 195) 1 265	0.026
Number of subscriber Median (min-max) IQR	109.5 (0-10 2659) 492	427 (4-102 659) 5 495	<0.0001
Number of like Median (min-max) IQR	1 (0-80) 5	7 (0-58) 23	0.002
Number of dislike Median (min-max) IQR	0 (0-25) 1	0 (0-8) 1	0.472
Source n(%)			
Government/news agencies, university/professional organizations/physician-groups	7 (6.4%)	7 (16.3%)	0.053
Medical-advertisements/for-profit-companies	54 (49.1%)	28 (62.1%)	0.066
Individual physician	34 (30.9%)	7 (16.3%)	0.07
Unknown	15 (13.6%)	1 (2.3%)	0.041
Target audience - Medical target n(%)	82 (74.5%)	40 (93%)	0.036
Patient positioning	51 (46.4%)	31 (72.1%)	0.004
Ultrasound setting n(%)	6 (5.5%)	6 (14%)	0.79
Development of the démonstration			
Clinical location of the needle entrance n(%)	36 (32.7%)	39 (90.7%)	<0.0001
Description of local anatomy n(%)	36 (32.7%)	37 (86%)	<0.0001
Description of the anatomical relation in the ultrasound image n(%)	39 (35.5%)	38 (88%)	<0.0001
US location of the injection site n(%)	49 (44.5%)	40 (93%)	<0.0001
Viewing of needle progression and injection n(%)	71 (64.5%)	29 (67.4%)	0.735
Accurate injection n(%)	51 (68%)	28 (90.3%)	0.045
Technical solutions of the demonstration n(%)			
Real patient and US-images only or along with mannequins or diagrams	33 (29.7%)	11 (25.6%)	0.609
US-images only or along with mannequins or diagrams	47 (42.3%)	25 (58.1%)	0.078
Mannequins and/or diagrams and/or oral description	31 (28%)	7 (16.3%)	0.133
Compliance with aseptic rules (n=57)			
Probe protection (n= 44) n(%)	8 (24.2%)	2 (18.8%)	0.678
Distance probe/needle to over 1 centimeter (n= 37) n(%)	19 (70.4%)	7 (70%)	1
Skin antispesis (n= 35) n(%)	21 (77.8%)	7 (87.5%)	1
Gloves wearing (n= 45) n(%)	25 (73.5%)	9 (81,8%)	0.705

(IQR : Interquartile range)

FIGURES

Figure 1: Flow chart of the selection of the videos.

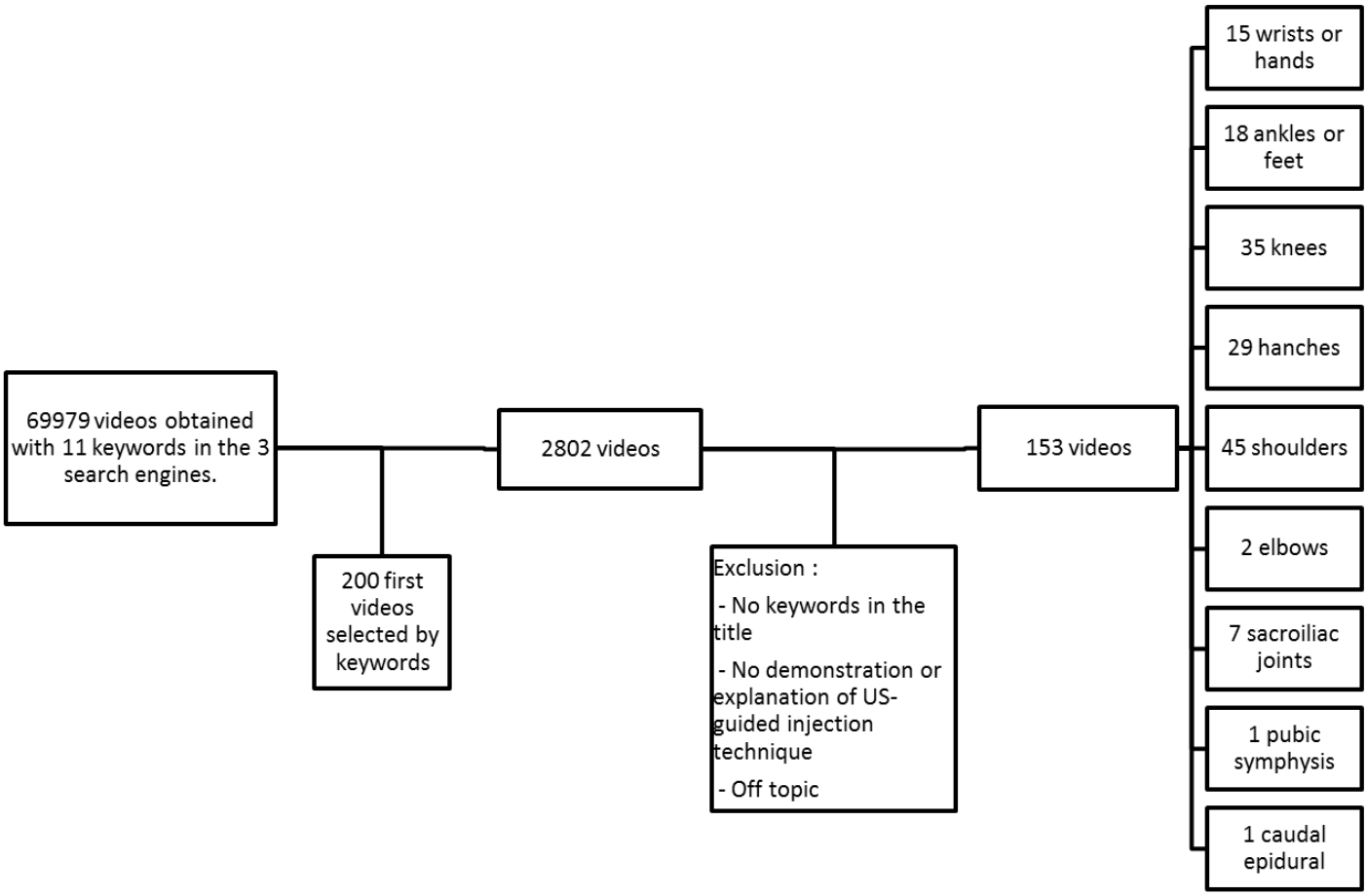


Figure 2: Number of videos based on the year of publication

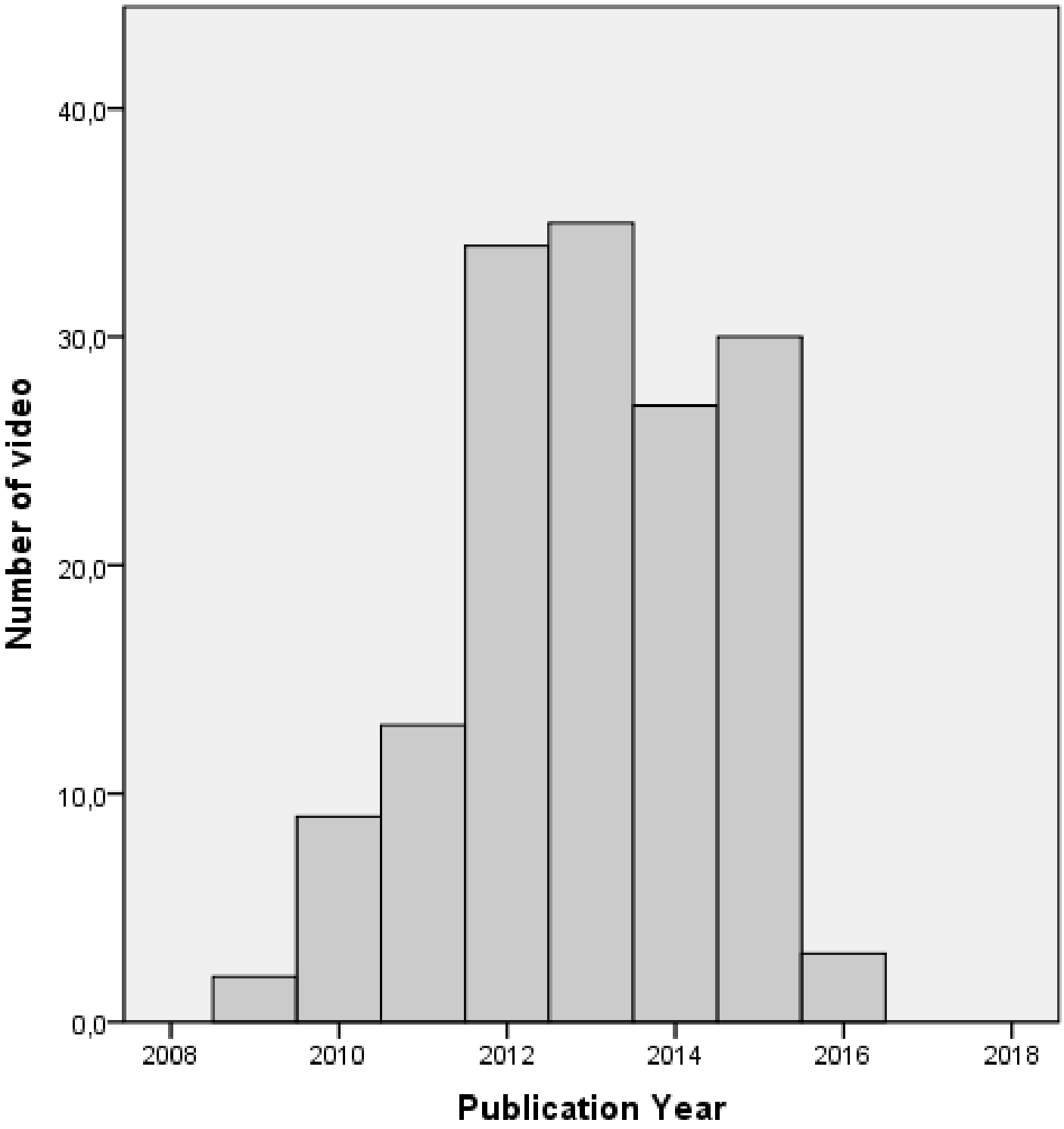


Figure 3: Correlation between the number of visit (NUMVISIT) and the number of like for each YouTube video (LIKE) (p<0.0001; r=0.708)

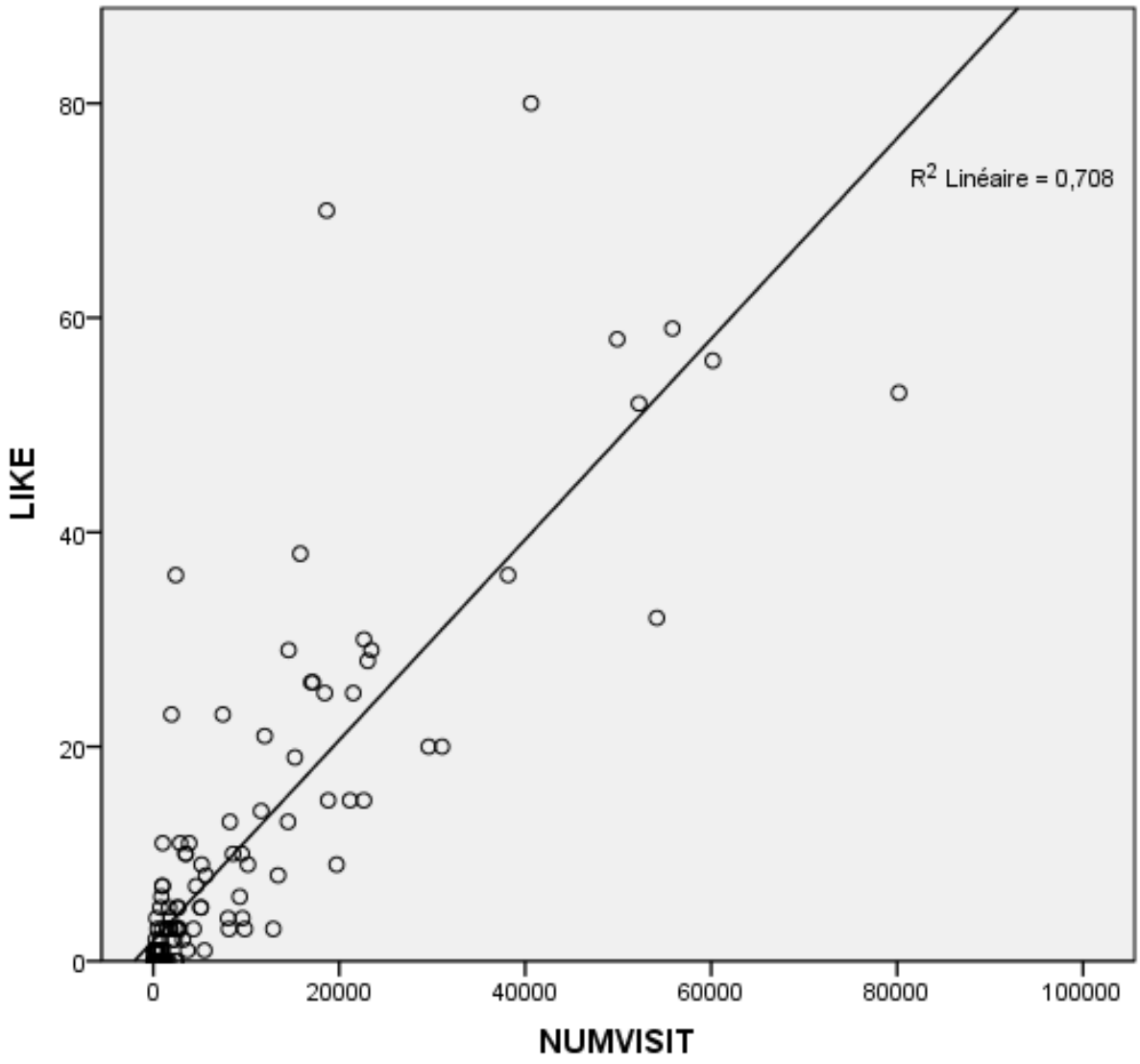
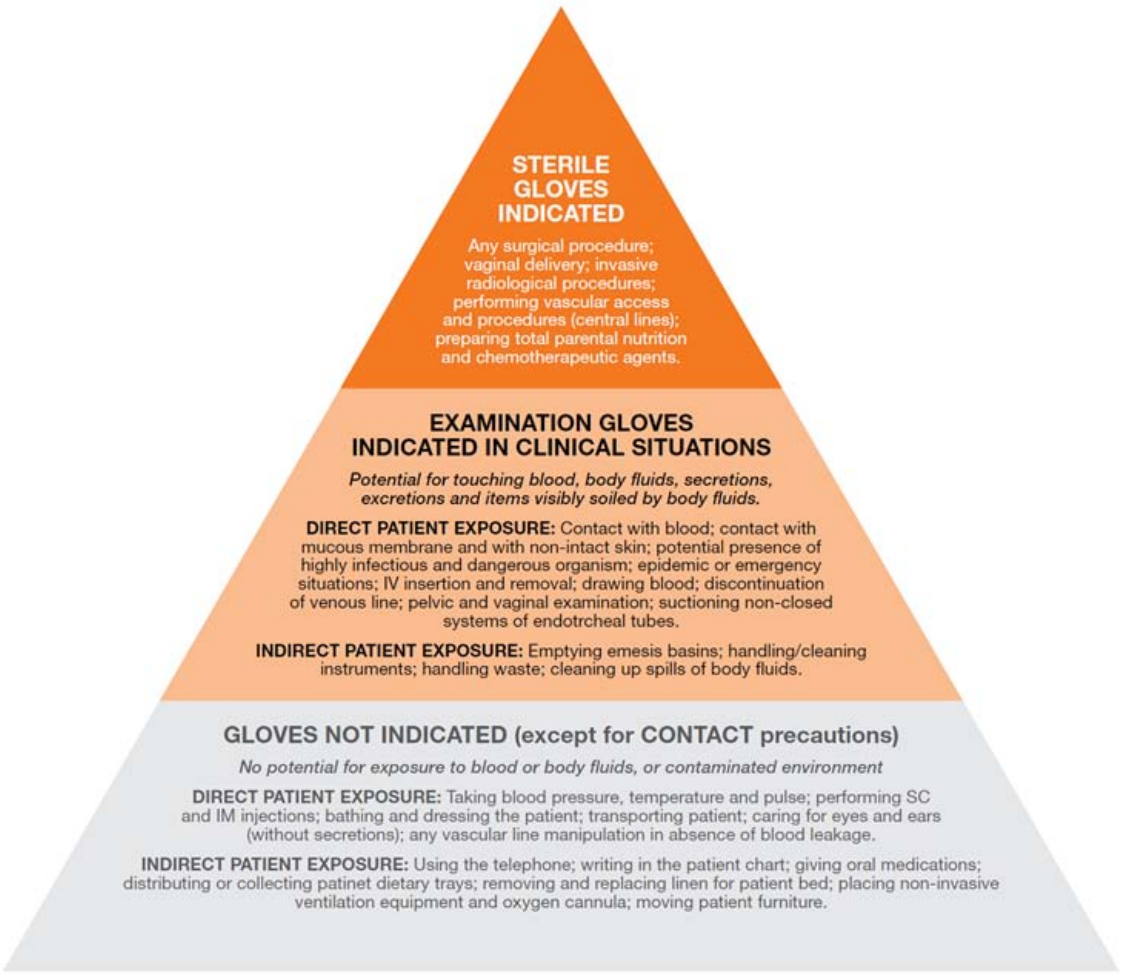


Figure 4: WHO glove use information leaflet (août 2009)



ANNEXE

Section 1

IS THE PUBLICATION RELIABLE?

1 Are the aims clear?

No		Partially		Yes
1	2	3	4	5

HINT Look for a clear indication at the beginning of the publication of:

- what it is about
- what it is meant to cover (and what topics are meant to be excluded)
- who might find it useful.

If the answer to Question 1 is 'No', go directly to Question 3

2 Does it achieve its aims?

No		Partially		Yes
1	2	3	4	5

HINT Consider whether the publication provides the information it aimed to as outlined in Question 1.

3 Is it relevant?

No		Partially		Yes
1	2	3	4	5

HINT Consider whether:

- the publication addresses the questions that readers might ask
- recommendations and suggestions concerning treatment choices are realistic or appropriate.

4 Is it clear what sources of information were used to compile the publication (other than the author or producer)?

No		Partially		Yes
1	2	3	4	5

HINT

- Check whether the main claims or statements made about treatment choices are accompanied by a reference to the sources used as evidence, e.g. a research study or expert opinion.
- Look for a means of checking the sources used such as a bibliography/reference list or the addresses of the experts or organisations quoted.

Rating note: In order to score a full '5' the publication should fulfil both hints. Lists of *additional* sources of support and information (Q7) are not necessarily sources of *evidence* for the current publication.

5 Is it clear when the information used or reported in the publication was produced?

No		Partially		Yes
1	2	3	4	5

HINT Look for:

- dates of the main sources of information used to compile the publication
- date of any revisions of the publication (but not dates of reprinting)
- date of publication (copyright date).

Rating note: The hints are placed in order of importance – in order to score a full '5' the dates relating to the first hint should be found.

6 Is it balanced and unbiased?

No		Partially		Yes
1	2	3	4	5

HINT Look for:

- a clear indication of whether the publication is written from a personal or objective point of view
- evidence that a *range* of sources of information was used to compile the publication, e.g. more than one research study or expert
- evidence of an external assessment of the publication.

Be wary if:

- the publication focuses on the advantages or disadvantages of one particular treatment choice without reference to other possible choices
- the publication relies primarily on evidence from single cases (which may not be typical of people with this condition or of responses to a particular treatment)
- the information is presented in a sensational, emotive or alarmist way.

7 Does it provide details of additional sources of support and information?

No		Partially		Yes
1	2	3	4	5

HINT Look for suggestions for further reading or for details of other organisations providing advice and information about the condition and treatment choices.

8 Does it refer to areas of uncertainty?

No		Partially		Yes
1	2	3	4	5

HINT

- Look for discussion of the gaps in knowledge or differences in expert opinion concerning treatment choices.
- Be wary if the publication implies that a treatment choice affects everyone in the same way, e.g. 100% success rate with a particular treatment.

Section 2

HOW GOOD IS THE QUALITY OF INFORMATION ON TREATMENT CHOICES?

N.B. The questions apply to the treatment (or treatments) described *in the publication*. Self-care is considered a form of treatment throughout this section.

9 Does it describe how each treatment works?

No		Partially		Yes
1	2	3	4	5

HINT Look for a description of how a treatment acts on the body to achieve its effect.

10 Does it describe the benefits of each treatment?

No		Partially		Yes
1	2	3	4	5

HINT Benefits can include controlling or getting rid of symptoms, preventing recurrence of the condition and eliminating the condition, both short-term and long-term.

11 Does it describe the risks of each treatment?

No		Partially		Yes
1	2	3	4	5

HINT Risks can include side-effects, complications and adverse reactions to treatment, both short-term and long-term.

12 Does it describe what would happen if no treatment is used?

No		Partially		Yes
1	2	3	4	5

HINT Look for a description of the risks and benefits of postponing treatment, of watchful waiting (i.e. monitoring how the condition progresses without treatment) or of permanently forgoing treatment.

13 Does it describe how the treatment choices affect overall quality of life?

No		Partially		Yes
1	2	3	4	5

HINT Look for:

- description of the effects of the treatment choices on day-to-day activity
- description of the effects of the treatment choices on relationships with family, friends and carers.

14 Is it clear that there may be more than one possible treatment choice?

No		Partially		Yes
1	2	3	4	5

HINT Look for:

- a description of who is most likely to benefit from each treatment choice mentioned, and under what circumstances
- suggestions of alternatives to consider or investigate further (including choices not fully described in the publication) before deciding whether to select or reject a particular treatment choice.

15 Does it provide support for shared decision-making?

No		Partially		Yes
1	2	3	4	5

HINT Look for suggestions of things to discuss with family, friends, doctors or other health professionals concerning treatment choices.

Section 3

OVERALL RATING OF THE PUBLICATION

16 Based on the answers to all of the above questions, rate the overall quality of the publication as a source of information about treatment choices

Low		Moderate		High
Serious or extensive shortcomings		*Potentially important but not serious shortcomings*		*Minimal shortcomings*
1	2	3	4	5

SIRIS recommandations for patient, practionner and material asepsis and adapted environnement for interventionnal rhumatology

	Level 1 Usual injections and acts	Level 2 More complex injections and acts
Type of injection	Periarticular (shoulder, elbow, wrist, hip, knee, ankle, foot, plantar fascia, trigger finger, finger retinaculum section[a]) Tunnels (carpal, tarsal, Morton, pelvic, shoulder) Articular (shoulder complex, elbow, wrist, finger, hip, sacroiliac, knee, ankle, tarsal, foot, sternoclavicular, ATM, interapophyseal) Epidural (interlaminar or caudal) or foraminal	Puncture aspiration of calcification, cementoplasty, kyphoplasty, aponeurotomy, wrist retinaculum section Bone, synovial or muscular biopsies
Patient asepsis	Local disinfection of the skin using iodine or Chlorhexidine antiseptic, wait 2′ (if alcohol solution: 30″) "No touch" skin procedure Clean in 5 steps if poor cleanliness	Local disinfection of the skin using iodine or Chlorhexidine antiseptic, wait 2′ (if alcohol solution: 30″) "No touch" skin procedure Clean in 5 steps if poor cleanliness
Practitioner's asepsis	Clean hands (hydroalcoholic gel) after each patient, non-sterile gloves Paper mask, glasses if risk of projection Clean gown or clothes	Clean hands (hydroalcoholic gel) after each patient, sterile gloves Paper mask, glasses if risk of projection Clean gown or scrub
Material asepsis	Single-use equipment Clean or sterile compresses and sterile syringe "No touch" sterile needle	Single-use equipment Clean or sterile compresses and sterile syringe "No touch" sterile needle
Guided injections	Ultrasound: probe and cable cleaned with wipe or antiseptic solution, non-sterile probe protection (+non-sterile gel), respect the distance needle - probe > 1 cm Fluoroscopy: protective material cleaned with antiseptic after each patient	Ultrasound: probe and cable cleaned with wipe or antiseptic solution, sterile probe protection (+non-sterile gel), respect the distance needle - probe > 1 cm Fluoroscopy: protective material cleaned with antiseptic after each patient
Patient risk	High infectious risk judged important[b]: possible evaluation case by case to pass to level 2[a] General acceptable risk: ASA[c] 1–2 even 3 Anaesthesia: local or digital block or distal block	High infectious risk: reinforced level 2 may be considered[d] General risk: ASA[c] 1–2–3 even 4 Anaesthesia: local or locoregional, plexus block, possible associated sedation, gas and air[a] Anaesthetist available at proximity if necessary
First aid kit	Blood pressure instrument, stethoscope, oxygen[e] (mask or nasal canula) SC adrenalin, SC atropine, corticoid, antihistamine (+analgesics, NSAIDs) Optional: anticonvulsant, bronchodilator, intravenous fluids	Blood pressure instrument, stethoscope, thermometer, ECG apparatus, oxygen (mask or nasal cannula), oxymeter, intubation and aspiration cannula, laryngoscope, ventilation mask, ventilator (manual or automatic), defibrillator, SC adrenaline, SC atropine, corticoid, antihistamine, bronchodilator, ephedrine, anticonvulsant (Flumazenil type), ± muscle relaxant (Dantrolene type) (+analgesics, NSAIDs) Intravenous perfusion material, physiological serum and hyperosmolar solution
Environment	Fitted out consultation room: treatment area separate from the office area, hygiene traceability, single-use equipment, asepsis of potentially unclean elements (reinforced for guided acts), circuit for waste disposal, aeration, washable examination table, swivel lamp, portable tablet, wash basin, closed cabinet Optional assistant	Fitted out consultation room with in addition: zone for cleaning and disinfection, reinforced and regular asepsis, decontamination zone, operating table [± ventilation, sas (air-lock) entrance, electric generator] Simple recovery room Assistant

SIRIS: Section Imagerie et Rhumatologie Interventionnelle de la Société française de rhumatologie.

[a] Possibility of an intermediate level 2a (sterile gloves, sterile probe protection, optional assistant).

[b] Ageing, malnutrition, obesity, diabetic, prior surgery, haematopathy, cirrhosis, distant infections, carrying AIDS, iatrogenic (chemotherapy, biotherapy) or family immunodeficiency.

[c] ASA score: 1 = patient normal; 2 = patient with moderated systemic anomaly; 3 = patient with severe systemic anomaly; 4 = patient with severe systemic anomaly representing a constant vital threat; 5 = patient moribund whose survival is unlikely without intervention.

[d] Addition of cap and sterile scrub.

[e] This HAS recommendation for level 1 is not approved by the majority of the experts.

Vu, le Président du Jury,
(tampon et signature)

Vu, le Directeur de Thèse,
(tampon et signature)

Vu, le Doyen de la Faculté,
(tampon et signature)

SERMENT MEDICAL

Au moment d'être admis à exercer la médecine, je promets et je jure d'être fidèle aux lois de l'honneur et de la probité.

Mon premier souci sera de rétablir, de préserver ou de promouvoir la santé dans tous ses éléments, physiques et mentaux, individuels et sociaux.

Je respecterai toutes les personnes, leur autonomie et leur volonté, sans aucune discrimination selon leur état ou leurs convictions. J'interviendrai pour les protéger si elles sont affaiblies, vulnérables ou menacées dans leur intégrité ou leur dignité. Même sous la contrainte, je ne ferai pas usage de mes connaissances contre les lois de l'humanité.

J'informerai les patients des décisions envisagées, de leurs raisons et de leurs conséquences. Je ne tromperai jamais leur confiance et n'exploiterai pas le pouvoir hérité des circonstances pour forcer les consciences.

Je donnerai mes soins à l'indigent et à quiconque me les demandera. Je ne me laisserai pas influencer par la soif du gain ou la recherche de la gloire.

Admis dans l'intimité des personnes, je tairai les secrets qui me seront confiés. Reçu à l'intérieur des maisons, je respecterai les secrets des foyers et ma conduite ne servira pas à corrompre les mœurs.

Je ferai tout pour soulager les souffrances. Je ne prolongerai pas abusivement les agonies. Je ne provoquerai jamais la mort délibérément.

Je préserverai l'indépendance nécessaire à l'accomplissement de ma mission. Je n'entreprendrai rien qui dépasse mes compétences. Je les entretiendrai et les perfectionnerai pour assurer au mieux les services qui me seront demandés.

J'apporterai mon aide à mes confrères ainsi qu'à leurs familles dans l'adversité.

Que les hommes et mes confrères m'accordent leur estime si je suis fidèle à mes promesses ; que je sois déshonoré et méprisé si j'y manque.