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The Flat Panel Volumetric Computed Tomography in In Vivo Tissue Engineering of Bone: Possibilities and Limitations

By Christian Beltzer & Stefan Endres

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Abstract- The scaffold-based tissue engineering of bones is an extremely promising concept with regard to the regeneration of major bone defects due to trauma, tumour or developmental abnormalities as well as for the treatment of pseudo-arthroses. The in vivo testing of implants is a significant phase in the development of specimens for the clinical application of suitable scaffolds. The collection of an optimal amount of information from these initial – clinical - tests demands, ideally, the most diagnostically conclusive studies possible. We tested the procedure of flat panel volumetric computer tomography (fpvCT) thus far virtually untried in the area of bone tissue engineering for the in vivo evaluation of small animal experiments and compared it with other methods (projection radiography, micro-CT, histology).

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THEFLATPANELVOLUMETRICCOMPUTEDTOMOGRAPHYININVIVOTISSUEENGINEERINGOFBONEPOSSIBILITIESANDLIMITATIONS

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The Flat Panel Volumetric Computed Tomography in in Vivo Tissue Engineering of Bone: Possibilities and Limitations

Christian Beltzer [α] & Stefan Endres [σ]

Abstract- The scaffold-based tissue engineering of bones is an extremely promising concept with regard to the regeneration of major bone defects due to trauma, tumour or developmental abnormalities as well as for the treatment of pseudo-arthroses. The in vivo testing of implants is a significant phase in the development of specimens for the clinical application of suitable scaffolds. The collection of an optimal amount of information from these initial – clinical - tests demands, ideally, the most diagnostically conclusive studies possible. We tested the procedure of flat panel volumetric computer tomography (fpvCT) thus far virtually untried in the area of bone tissue engineering for the in vivo evaluation of small animal experiments and compared it with other methods (projection radiography, micro-CT, histology). The main questions were whether in situ osteosynthesis decreased representability (artefact formation), the scaffold could be demonstrated by means of fpvCT, and whether the course of degradation and bone growth could be observed, the course of growth precisely evaluated, neoformation of vessels demonstrated in the osteotomic cleft, and what conclusions could be reached with regard to animal models and osteosynthesis.

We worked with a CT from the company GE Global Research, Niskayuna, New York. This flat panel volumetric computed tomograph functions with two flat panel radiographic sensors with a resolution of 1024x1024 pixels in each instance.

We were able to demonstrate that the fpvCT is an alternative to be considered seriously in terms of the in vivo evaluation of small animal experiments on behalf of scaffold-based tissue engineering. It is superior to projection radiography and can replace the micro-CT, if high resolution is not required. Major advantages of this method over the micro-CT are the shorter scan time, the lower radiation exposure, the larger presentable area and the possibility of carrying out several experiments on a single animal over the course of time. In terms of resolution the fpvCT is superior to the micro-CT. Above all with respect to issues concerning the neoformation of bone and the differentiation between degraded scaffold and new bone, histology is indispensable.

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I. Introduction

In the scaffold-based tissue engineering of bones, experiments on small animals are the first practical test of the scaffold and a significant intermediate step on the road to the clinical testing of the material. As an experimental model the critical size defect (CSD, defect of critical dimensions) has proven its value [1,2]. Frequently utilised on the Ossa longa of animals, stabilisation of a defect requires sufficient osteosynthesis. Babis et al were able to demonstrate that stable osteosynthesis is a decisive condition for the mending of the scaffold [3]. This makes osteosynthesis a critical factor in the breadboard. Additionally, the correct location of the scaffold, the course of degradation and that of bone mending within the defect must be presented as accurately as possible and, ideally, in terms of their course.

Therefore, central issues with regard to the model of the critical size defect in scaffold-based tissue engineering of bone are the following:

- Is the scaffold situated correctly postoperatively (in the osteotomic cleft)?
- What is the degradation behaviour of the scaffold over time?
- Is there bone ingrowth into the scaffold?
- Is osteogenesis occurring in the scaffold?
- What characteristics demonstrate the osteogenic activity?
- How do various scaffolds perform in comparative terms?
- Is the defect closing?

Therefore, suitable assessment methods are required for monitoring the course and outcome of the series of experiments, evaluating them and answering all relevant of the above questions. Significant here is above all the monitoring of the mending process in vivo, including in order to be able to recognise and evaluate the influence of the breadboard, above all that of osteosynthesis, upon the results.

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II. Status Quo

Presently, it is above all projection radiography, the micro-CT and histology that are used for the evaluation of in vivo experiments regarding scaffold-based tissue engineering. Unfortunately, with these methods either resolution and/or three-dimensional presentability are insufficient and/or the method is not compatible with the survival of the animal and an intact specimen.

Based on the high radiation dosage and the long exposure time, the micro-CT is not indicated for repeated tests on an individual in vivo, while additionally usually the volume to be studied must be significantly reduced [4]. Added to this is the fact that osteosynthetic material frequently causes very significant artefacts, so that this must usually be removed first. This at least partially destroys the specimen.

The same applies to histology: the bone scaffold structure must be cut. This results in a loss of part of the specimen. Additionally, the preparatory process is protracted and complex, and three-dimensional presentation is not possible.

Projection radiography as a two-dimensional system can be repeated frequently over the course of time. Nonetheless, the bone mending process can only be assessed to a limited extent due to the lack of three-dimensionality and this indeed can lead to erroneous assessments with regard to dual-plane exposures. In order to at least partially compensate for these disadvantages, some research groups such as Fialkov et al have chosen to use scores that they themselves have developed to assess roentgen images [5].

Conventional computer tomography permits three-dimensional representation, however with a maximal resolution of 0.5 x 0.5mm in the plane and 0.25-1mm in the z-axis. This is too low for the detailed representation of such bony structures as trabeculae and the scaffold [6].

Thus it is clear that a sparing procedure for the high-resolution, three-dimensional representation of the mending process in vivo over the course of time is still to be striven for.

Flat panel volumetric computed tomography provides a high-resolution, three-dimensional representation of tissue in vivo. Obert et al were able to visualise bones down to their trabecular structure in mice [4]. It is also possible to demonstrate vascular neoformation using contrast media [7,8]. This is a critical point in the tissue engineering of bones, because vascular neoformation or the ingrowth of vessels in the scaffold is a basic requirement for the formation of new bone in a defect.

Weinand et al utilised the fpvCT to measure a distal thumb phalanx in humans in order to use CAD technology with these data to produce a scaffold. After cell colonisation and implantation of the scaffold subcutaneously in a mouse, the fpvCT was used to monitor the course of the procedure [9].

Thus far the fpvCT has not yet been used to evaluate an in vivo model on a small animal based on critical size defect. Our objective was to determine whether this promising method represents an alternative to the already known methods for evaluating scaffold-based tissue engineering.

III. Material and Methods

The rabbit was obtained from the company Behring Aventis Marburg and allowed to become accustomed to its stables for a week before the operation. Premedication was effected with atropine, and anaesthesia induced with xylazine and ketamine IM. The left femur was shaved and disinfected, the operative field sterilely draped and disinfected again. In summary, a 12 mm piece was removed from the femoral diaphysis and a scaffold of calcium phosphate/PLGA was placed. Osteosynthetic supply was effected using a mandibular plate (Stryker) and 2.7 mm blocking screws. The screw length was chosen individually (10-16 mm). Caprofen was used for postoperative pain therapy.

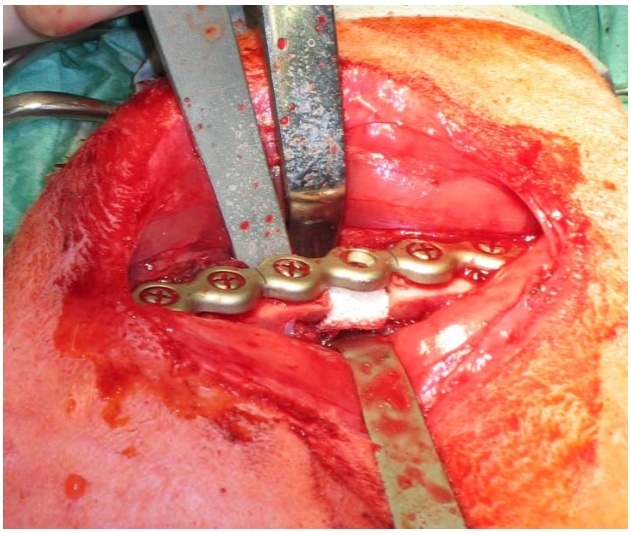


Figure 1 : Operation site; recognisable are the scaffold introduced into the osteotomy, and osteosynthesis

The first fpvCT evaluation took place two weeks, and the second four weeks, postoperatively. Thereafter an fpvCT was carried out every four weeks. After 20 weeks the rabbit was killed, the osteosynthetic material was removed and a micro-CT and a histological examination of the osteotomic cleft took place. Parallel projection radiographic studies were carried out.

The same anaesthetic method was chosen for the fpvCT as described above. First a native and then a contrast CT were carried out. The studies were carried out using a new type of CT from the company GE Global Research, Niskayuna, New York. This flat panel volumetric computed tomograph comprises two flat

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panel roentgen sensors with a resolution of 1024 x 1024 pixels in each instance. The maximal Z-axis is 21cm per scan. A more precise description of the volume computer tomograph is contained in the literature [4,7,8]. Our images were obtained with 120 kV and 40 mA. The rotation time of a step was 8 seconds at a length on the Z-axis of 42 mm. Two steps were recorded, resulting in a Z-axis of 84 mm.

For the application of the contrast medium, after induction of anaesthesia a Braun cannula was introduced into the aural vein of the rabbit. 10 ml of contrast medium (Imeron 300, Altana, Constance) was injected 50 seconds before the scan. At an average number of exposures of 420, a voxel magnitude of 0.2 mm3 and a field of view of 102x102x84 mm3 were yielded in the reconstruction.

After four and 20 weeks, in each instance half the rabbits were killed. The left femur was removed, embedded in rigid plastic (Technovit, Fa. Kulzer) and the osteosynthetic material was removed. Then the micro-CT was carried out. The histological specimen was prepared after the micro-CT using the thin slice technique, and then dyed with toluidine blue.

The examination and evaluation of the fpvCT data was undertaken without knowledge of the results of the micro-CT and histology. The fpvCT data were reconstructed using a Linux-based network of seven 7 dual core 2.2GHz processor PCs and a cone beam-filtered back projection algorithm. The reconstruction time was approximately 13 minutes. The images were displayed on an Advantage Workstation, Version 4.1 from the company GE Medical Systems, based on a Linux PC with dual core 2.2GHz processor and 4GB RAM. The evaluation was effected in maximum intensity projection (MIP) and volume rendering representation, viewing both the three-dimensional reconstruction and the sagittal, axial and coronary interfaces.

After evaluation of the fpvCT, the results were compared to those of the micro-CT and the histology.

IV. Results

A total of 19 animals were observed over the defined experimental period. Of these, 8 animals had implanted scaffolds and one animal had an empty defect for 4 weeks and 8 animals with scaffolds and two animals with empty defects over 20 weeks.

Four animals were excluded for reasons of osteosynthetic insufficiency, and four animals experienced complications during the application of the contrast medium (see below).

a) Projection radiography

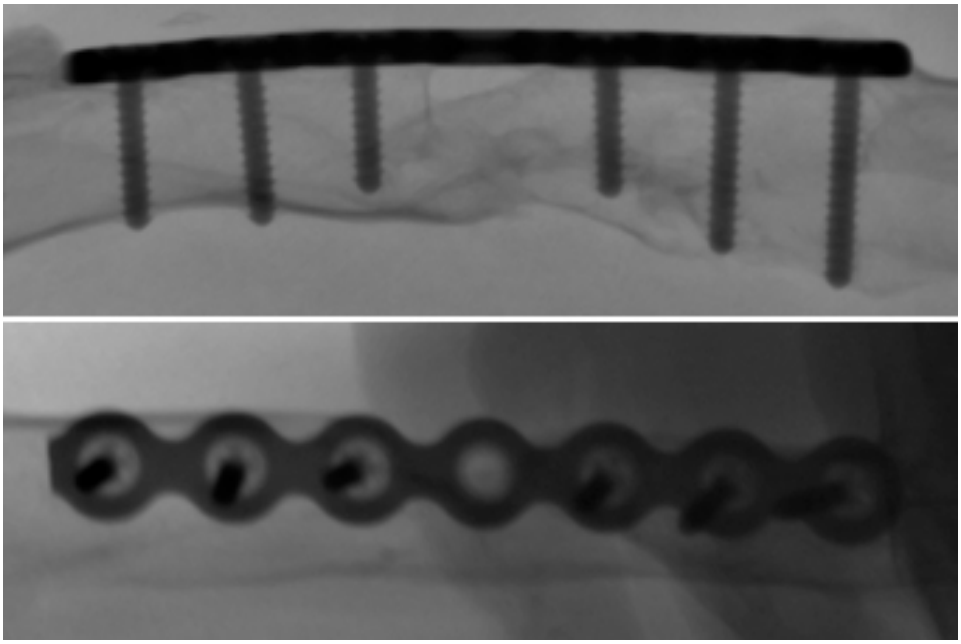
During postoperative roentgen controls, no scaffold could be demonstrated in the osteotomic cleft. An irregular shadowing was noted in some animals; however this could not be identified unequivocally, nor was it possible to determine precise contours. Consequently, the correct positioning of the scaffold and the degradation could not be demonstrated or confirmed.

Bone formation in the osteotomic cleft was demonstrated in all animals. Nonetheless, it was impossible to differentiate with certainty between ingrowing bone and bone neoformation in the scaffold. Based on the growth sample one could only make conjectures. During the further course, in the presence of a virtually closed osteotomic cleft, no further differentiation was possible.

After 20 weeks, in the context of an empty defect the closure of the osteotomic cleft was suspected, because a continuous cortical line could be demonstrated on both planes (see Fig 2).

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Figure 2 : In native radiographic terms, the fracture cleft appears closed (upper picture lateral projection, lower picture ap-projection, sinistral distal, dexter proximal)



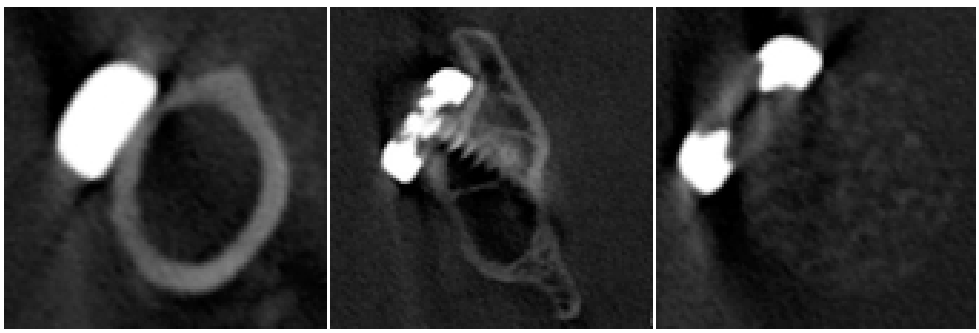
Osteosynthesis could be assessed well on x-rays. For example, the four osteosynthetic insufficiencies in the visualisation on two planes were observed immediately. For the most part there was avulsion of the screws distal to the osteotomic cleft.

b) Flat panel volumetric computer tomography

The data sets were evaluated at the workstation in maximum intensity projection. First the three-dimensionally reconstructed femur was viewed, and then the interfaces parallel, perpendicular and axial to the lamina. Based on the isotropic voxels it was possible to set any other desired interface without any compromise in image quality.

In addition to the bone corticalis, trabecular structures were also shown quite well. In the sectional images one could even identify extremely fine fissures in the bone and changes in the bone structure (see Fig 3).

Figure 3 : Trabeculae, scaffold and osteosynthesis can be clearly recognised with the fpvCT without significant artefact formation (axial slices, left picture through the diaphysis of the femur proximal the osteotomic cleft, central picture through the femoral neck, right picture through the middle of the osteotomic cleft)

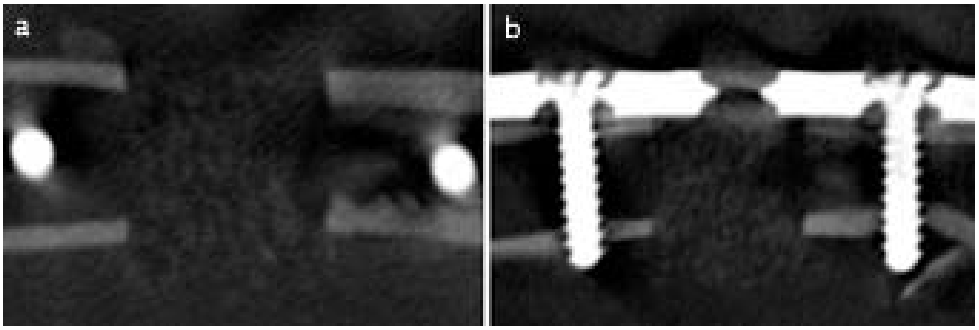


All in all, there was only very minimal artefact formation due to the osteosynthetic material. Shadowing was seen parallel to the osteosynthetic material and ray-like artefacts radiated from the lamina (see Fig 3). These, however, did not significantly hinder the evaluation.

Postoperatively one could identify the scaffold very well, and delineate it from the surrounding bone and connective tissue, in all the animals (see Fig 3 and 4). It was always positioned correctly in the osteotomic cleft. The degradation behaviour, as well, could also be observed very well up to 12-16 months postoperatively. At these times the scaffold was degraded to such an extent that it could no longer be shown sufficiently via fpvCT, nor could it any longer be differentiated from bone.

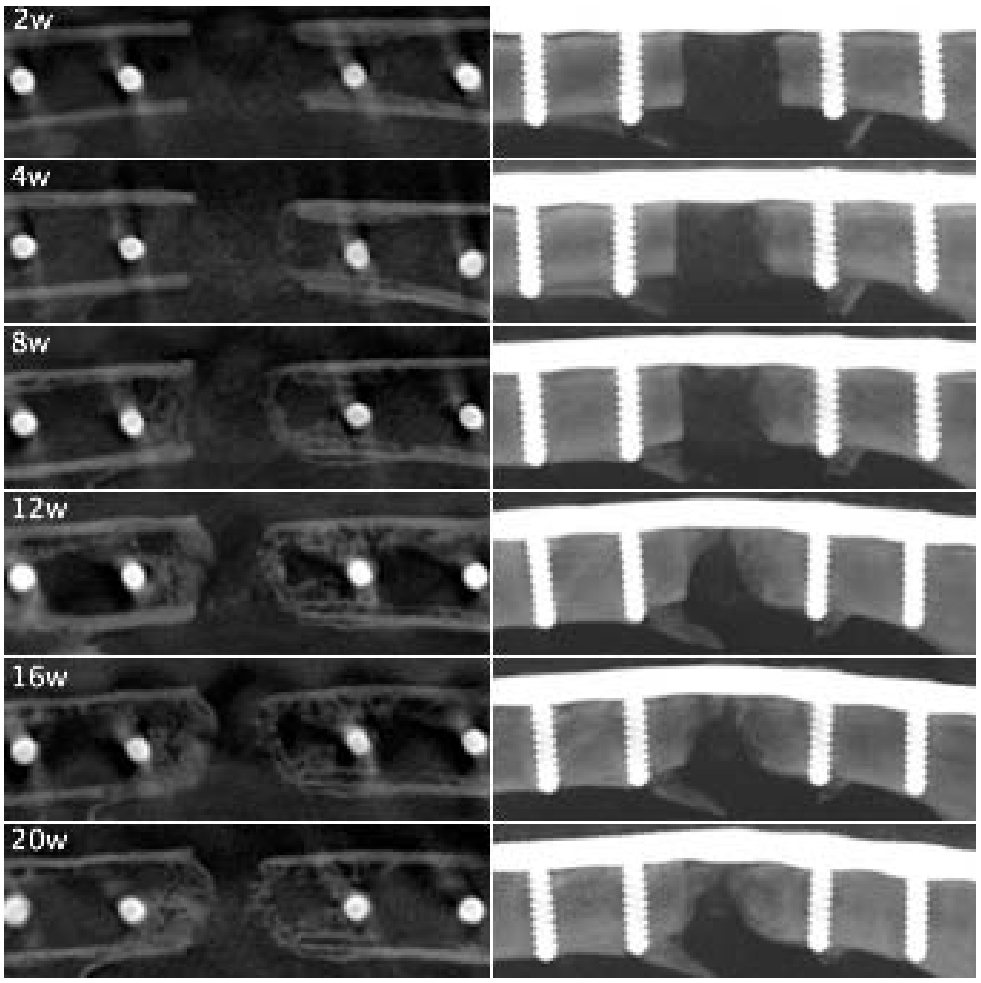
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Figure 4 : The scaffold is clearly recognisable in the osteotomic cleft (left picture coronar slice in the middle ofe the osteotomic cleft, right picture sagital slice in the middle of the osteotomic cleft)



The bone growing in from the outside could be clearly delineated from the bone formed in the osteotomic cleft on the fpvCT. Various different growth forms of the ingrowing bone could also be identified, thus yielding significant information concerning the breadboard. For example, cap formation beyond the medullary space radiating from the corticalis was demonstrated in nearly all the test animals, which enclosed the medullary space and thus made mending of the scaffold impossible (see Fig 5).

Figure 5 : Growth behaviour of the bone over the course of time (indicated in weeks from top to bottom, right column the reconstructed radiographs, left column coronar slices in the middle of the osteotomic cleft, sinistral distal, dexter proximal)

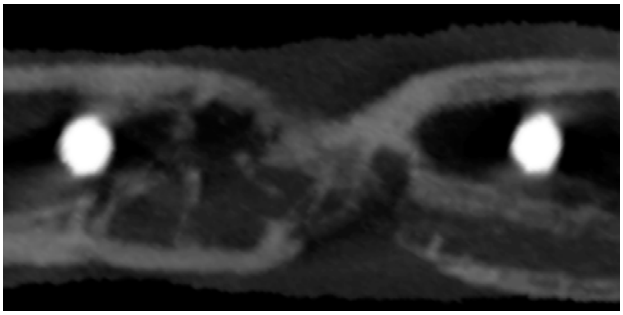


For example, on the fpvCT no bony connection between ingrowing bone and scaffold could be demonstrated; gaps always remained. During the closure of the osteotomic cleft suspected on projection roentgen, as well, it was possible on fpvCT to demonstrate a non-union (see Fig 6). Sclerotic zones were demonstrated in the scaffold over the course of time, but one could not differentiate, over the course of

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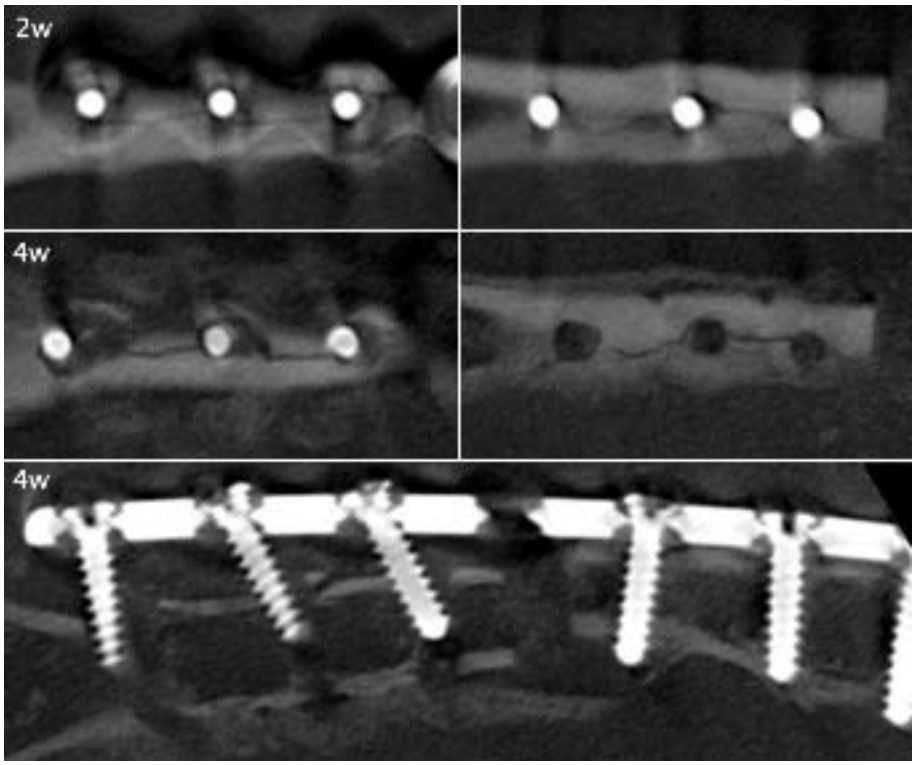
time, between bone neoformation and compressed calcium phosphate components of the scaffold.

Figure 6 : Identifiable non-union of the bone that appeared bridged on projection roentgen



The pfvCT was extraordinarily useful for the assessment of the osteosynthetic process. By way of the high-resolution representation of the entire femur, for the first time fine fissures in the bone between the screws could be identified. For example, one could derive significant information concerning the formation of screw fissures and thus osteosynthetic failure. Stress-related remodelling around the screws in the bone could also be clearly identified (see Fig 7).

Figure : 7 Osteosynthetic failure after intraoperative fissure formation (coronar slices in the first two rows, on the left directly below the plate, on the right the opposite cortices), lowest sagital slice showing the dislocation of the plate and screws (distal sinstral, proximal dexter)



To represent the vessels in the region of the femoral bone and the osteotomic cleft, a contrast medium CT was carried out on the test animals. It was expected that newly proliferating vessels would be identified. However, no blood vessels could be identified in the area of the bone and the osteotomic cleft. Vessels were only visualised in the large leg veins. In 4 test animals a fatal circulatory reaction occurred shortly after application of the contrast medium. However, this never occurred at the first administration, but only at the third or fourth test. We suspect stress- and volume-related acute circulatory insufficiency. In the absence of usefulness and considering the high risk for the animals, the contrast CT was then terminated.

V. Discussion

The fpvCt is a relatively new procedure for the high resolution, three-dimensional representation of tissue in vivo. It has been demonstrated in various publications that it is excellent for the representation of

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bone details and vessels and is superior to traditional computer tomography [4, 6, 8-11]. At comparable radiation dosage and test duration, the fpvCT achieves significantly better local resolution (in our case 0.2mm3) than traditional computer tomography. By means of the technique of isotropes, that is to say cubic voxels, any chosen interface can be represented without compromise in quality. This is extremely useful above all in the precise assessment of bone growth. In comparison with the micro-CT, the advantage of the fpvCT is that it requires a much lower dosage of radiation, so that it can be used several times in one animal in vivo. The scan time is also significantly shorter (here 16 seconds).

Another decisive point is that studies of osteosynthesis were possible without significant artefact formation by the osteosynthetic material. This had not yet been demonstrated in the past. Additionally, the entire femur could be represented, something which had otherwise only been possible by way of projection radiography. For example, the entire osteosynthetic process could be observed in detail throughout the test period. This image material allowed significant conclusions to be reached with respect to the methodology of the critical size defect and, above all, osteosynthesis. For the first time, as well, the scaffold could be represented in vivo, allowing it to be demonstrated that the implant was in the correct location postoperatively and that the implant did not contract rapidly. Additionally, the degradation of the scaffold could be observed and the implant could be represented for a considerably longer time than is the case with projection roentgen. For a differentiation between bone neoformation on the one hand and the calcium phosphatase phase of the scaffold on the other, the resolution did not suffice, that is to say that no bone neoformation could be demonstrated in the scaffold. Based on the sclerotic zones in the scaffold, however, the suspicion is great.

Prior to the fpvCT studies, there had been considerable hope that vessels would be visualised. After the successful visualisation of neoangiogenesis in tumours in the mouse [7, 8] we hoped to be able to show vascular neoformation in and around the osteotomic cleft in vivo by way of contrast media using the fpvCT. However, this did not occur. Indeed it was possible to show the larger femoral vessels, however no small vessels in and around the bones or indeed in the osteotomic cleft could be represented. This was probably attributable to the field of view that was too large in comparison with the very small vessels. On the other hand, however, no central necrosis could be demonstrated. This was a clear indication of newly occurring, intact vessel supply in the osteotomic cleft.

Another critical point was the death of four rabbits in the context of the application of the contrast medium. An allergic reaction was most improbable, because the deaths occurred at the earliest at the time of the fourth contrast medium application. We assume that the rabbits, already under considerable stress due to their transport and examination (induction of anaesthesia), suffered circulatory shock when the contrast medium was administered. Rabbits are animals that are quite sensitive to stress, making a change in location and an unfamiliar environment particularly dangerous for them. According to our experience, an accustomisation phase of one to two hours in a quiet and air conditioned room prior to the study significantly lowers the stress load and therefore the cardiorespiratory risk.

In addition to the great advantages with respect to the representation of bones, a disadvantage is certainly the rarity of the fpvCT. Because the method is still only rarely used, one must generally expect long travel times or, better yet, the entire test process could take place where the fpvCTs are located, in order to spare the animals long transport periods. Another disadvantage in comparison with projection radiography is the significantly greater cost per procedure, while on the other hand the process does afford considerably more accurate statements concerning the course of mending. However, the fpvCT is not sufficient as a sole evaluation method, because even though the scaffold can indeed be shown, no concrete statements can be made concerning bone and vascular neoformation in the scaffold and osteotomic cleft. Unfortunately, a program for the quantification of bone ingrowth in the osteotomic cleft does not exist yet, something which could facilitate objectivisation of the results. At the moment there is only qualitative analysis. This is, however, a very valuable instrument for observing processes in the bone and osteotomic cleft over the course of time, promising to yield significant information concerning the breadboard and methodology.

VI. Conclusion

The fpvCT is more than simply an alternative to the projection roentgen and micro-CT. Under certain conditions, it can replace both of those evaluation methods. For example, qualitatively it is superior to the projection x-ray in every aspect, with its only disadvantage being higher costs and more test-related expenditures. The micro-CT can also be replaced if higher resolution can be done without. Beyond that, in our opinion the micro-CT offers no advantages over the fpvCT. The representation of very small vessels can be achieved by a smaller field of view, which would then require further examination and the administration of contrast medium. More extensive knowledge could only be realised through histology, which in terms of certain issues cannot be replaced by the fpvCT.

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Quality of Life Comparison in Chronic Pancreatitis Patients: A Case-Control Study

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Abstract- *Introduction:* Chronic pancreatitis presents a significant problem to healthcare practitioners as it affects many areas of a patient's health, including their physical, mental, and socioeconomic health. The Pancreatitis Quality of Life Instrument (PANQOLI) is the 1st instrument developed specifically to evaluate the quality of life of patients with chronic pancreatitis. This study compares a healthy control population with a chronic pancreatitis population using the PANQOLI to provide a normal distribution curve.

Methods: 56 patients with chronic pancreatitis were given the PANQOLI and compared with 52 healthy individuals (consisting of medical students and residents) who also completed the PANQOLI. Subgroup analysis was also performed to compare smokers and non-smokers, as well as malnourished and non-malnourished patients.

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Quality of Life Comparison in Chronic Pancreatitis Patients: A Case-Control Study

Samuel Han [α], Joan Kheder [σ], Julien Fahed [ρ], Lisa Bocelli [ω], Yoel Carrasquillo [¥], Amy Waccholtz [§] & Wahid Wassef [χ]

Abstract- ***Introduction:*** Chronic pancreatitis presents a significant problem to healthcare practitioners as it affects many areas of a patient's health, including their physical, mental, and socioeconomic health. The Pancreatitis Quality of Life Instrument (PANQOLI) is the 1st instrument developed specifically to evaluate the quality of life of patients with chronic pancreatitis. This study compares a healthy control population with a chronic pancreatitis population using the PANQOLI to provide a normal distribution curve.

Methods: 56 patients with chronic pancreatitis were given the PANQOLI and compared with 52 healthy individuals (consisting of medical students and residents) who also completed the PANQOLI. Subgroup analysis was also performed to compare smokers and non-smokers, as well as malnourished and non-malnourished patients.

Results: The chronic pancreatitis group scored significantly lower than the control group on the PANQOLI (56.2 vs. 92.3, $p < 0.0001$), with a lower PANQOLI score representing a worse quality of life. Within the chronic pancreatitis group, smokers had a lower PANQOLI score than non-smokers (52.8 vs. 60.1, $p<0.05$), while there was no difference between malnourished patients and non-malnourished patients (55.1 vs. 58.5, $p<0.46$).

Discussion: This study presents the 1st evaluation of a chronic pancreatitis population using the PANQOLI in comparison to a healthy population. As expected, the chronic pancreatitis population had a worse quality of life as did smokers compared to non-smokers, highlighting the potential use of the PANQOLI to objectively assess the impact of interventions in these patient groups.

I. Introduction

Chronic pancreatitis presents a significant medical problem to healthcare practitioners as it affects many aspects of a patient's health and has been found to be associated with a poor quality of life.1-2 A global problem, worldwide prevalence has been estimated to range from 3-20%.[3-6] Most often caused by alcohol consumption, chronic pancreatitis may also be caused by metabolic disorders (hyperlipidemia and hypercalcemia), and genetic disorders (including Cystic Fibrosis, SPINK, cationic trypsinogen mutations) 4. Characterized by progressive inflammatory changes in the pancreas, chronic pancreatitis often causes abdominal pain and symptoms of pancreatic insufficiency, such as steatorrhea and diabetes, are the predominant features of this disease. Studies have demonstrated the increased burden of chronic pancreatitis in areas such as physical health, most notably in pain, nutritional status, and diarrhea.1-2 Other areas affected include financial factors such as unemployment or early retirement, as well as mental health factors. 2 The socioeconomic burden has been found to be increasing as management of chronic pancreatitis entails the cost of admissions, the cost of pancreatic insufficiency, the cost of pain, and the cost of interventions, among other costs.8 This has been estimated to cost around $638 million a year.8 Furthermore, complications can include pseudocyst formation, pancreatic ascites, splenic vein thromboses, and pancreatic cancer.9 All these features combine to play a large role in altering the quality of life of these patients.2,10,11

To better manage patients with chronic pancreatitis and address patient-specific issues, an instrument called the Pancreatitis Quality of Life Instrument (PANQOLI) was developed.12 This instrument consists of 18 questions, and provides a comprehensive measure of quality of life measures. Validated in two separate studies involving over 300 patients in eleven clinical sites, the PANQOLI has shown excellent reliability and construct validity.13,14 This instrument represents the 1st disease-specific instrument created for evaluating quality of life in patients with chronic pancreatitis and has been utilized extensively at our institution since its inception.

This study reports the initial evaluation of the PANQOLI at our institution on patients with chronic pancreatitis compared to other control patients in order to help provide a normal distribution curve that can be applied as a standard for future use of the instrument.

II. Methods

The PANQOLI was administered to 56 patients previously diagnosed with chronic pancreatitis who regularly follow-up at our chronic pancreatitis clinic. The same instrument was given to a control population consisting of 52 individuals. The PANQOLI results were then compared between the groups. Subgroup analysis was also performed to compare smokers and non-

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smokers, as well as malnourished and non-malnourished.

a) Subjects

Patients with chronic pancreatitis required a diagnosis by either the presence of pancreatic calcifications on CT (Computed Tomography) scan or KUB (kidney, ureter, and bladder) imaging or the presence of 5 out of 9 criteria of pancreatic injury by endoscopic ultrasound (Please see Table 1 for further inclusion and exclusion criteria). Institutional Review Board (IRB) approval of the study was obtained and patients who met the inclusion/exclusion criteria were asked during a regularly scheduled visit if they wished to participate in this study. Subjects were then asked to sign an informed consent if they agreed to participate.

Table 1 : Inclusion - exclusion criteria for chronic pancreatitis patients

Inclusion criteria	Exclusion criteria
Patient must have abdominal pain, not related to other identifiable etiologies in conjunction with one of the following two features: (a) Presence of pancreatic calcification as demonstrated by an imaging study such as CT scan or KUB imaging (b) Presence of five out of nine criteria of pancreatic injury by endoscopic ultrasound in conjunction with a positive secretin stimulation test to confirm pancreatic insufficiency.	Patient to be excluded from the study if they have one of the following features: (a) Age less than 18 years (b) Comorbidities such as end-stage cancer (estimated survival < 6 months), HIV (T4 cell count < 50), end-stage congestive heart failure, end-stage chronic obstructive pulmonary disease, uncompensated cirrhosis, renal failure (on dialysis or with CrCl <25), or pre-existing diabetes mellitus (c) Non-English speaking

CT: computed tomography; KUB: kidney, ureter, and bladder; CrCl: creatinine clearance

The control population consisted of a relatively healthy group of subjects consisting of medical students and residents at our institution who do not have chronic pancreatitis. Informed consent was obtained if the subject agreed to participate in the study.

Demographic data collected included age, gender, race, smoking status, opiate use, and endoscopic ultrasound (EUS) characterization of disease severity.

b) Sub-Groups

Within the chronic pancreatitis population, patients were identified as smokers if they reported that they were active smokers. In terms of identifying malnourished patients, patients regularly followed at our clinic were routinely asked to fill out a Malnutrition Universal Screening Tool (MUST).15 Those patients scoring >2 were defined as being malnourished.

c) Statistics

Multivariate analysis was performed utilizing the Anova test and power was calculated to be 80%. Analysis was performed using SPSS software (IBM SPSS Version 21.0).

III. Results

A total of 56 patients in the chronic pancreatitis group and 52 patients in the control group participated in this study. The mean score of the PANQOLI in the chronic pancreatitis group was 56.2, compared to 92.3 in the control group, which was highly significant ($p<0.0001$) adjusting for age, race, gender, and smoking status, with a higher score representing a better quality of life. In terms of the sub-groups within the chronic pancreatitis group, smokers (n=30) had a mean score of 52.8 in comparison to non-smokers (n=26), who had a mean score of 60.1 ($p<0.05$), accounting for age, race, gender, opiate use, and EUS grading. In comparing by nutritional status, malnourished (n=18) patients had a mean of 55.1, while the non-malnourished (n=38) had a mean of 58.5, which was not significant ($p<0.46$). Please see Tables 2-4.

Table 2 : Comparison of chronic pancreatitis group with control group

Category	Chronic Pancreatitis Group (n=56)	Control Group (n=52)	p-value
Age (years)	48.7 ± 9.2	30 ± 4.1	$p<0.0001$
Gender	36 Female 20 Male	28 Females 24 Males	$p<0.18$
Race	49 Caucasian 5 Black 2 Hispanic	36 Caucasian 7 Asian 5 Indian 3 Hispanic 1 Black	$p<0.025$
Tobacco Use	30 Smokers 26 Non-smokers	1 Smoker 51 Non-Smokers	$p<0.0001$

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Opiate Use (mg of oral morphine/day)	125.4 ± 101.2	0	p<0.0001
EUS Grading of CP	Mild (28.6%) Mild-Moderate (7.1%) Moderate (48.2%) Moderate-Severe (5.4%) Severe (10.7%)	N/A	N/A
PANQOLI Mean Score	56.2 ± 14.6	92.3 ± 0.8	p<0.0001

EUS: endoscopic ultrasound; CP: Chronic Pancreatitis; PANQOLI: PANcreatitis Quality Of Life Instrument

Table 3 : Comparison of smokers with non-smokers

Category	Smoker (n=30)	Non-Smoker (n=26)	p-value
Age	45.8 ± 8.9	52.0 ± 8.6	**p<0.01**
Gender	Male (26.7%) Female (73.3%)	Male (46.2%) Female (53.8%)	p <0.13
Race	Caucasian (93.3%) Black (6.7%)	Caucasian (80.8%) Black (11.5%) Hispanic (7.7%)	p <0.23
Opiate Use (mg of oral morphine/day)	135 ± 93.9	114.3 ± 109.9	p <0.45
EUS Grading of CP	Mild (33.3%) Mild-Moderate (6.7%) Moderate (43.3%) Moderate-Severe (6.7%) Severe (10%)	Mild (32.1%) Mild-Moderate (7.7%) Moderate (53.8%) Moderate-Severe (3.8%) Severe (11.6%)	p<0.90
PANQOLI mean score	52.8 ± 11.9	60.1 ± 16.5	**p<0.05**

EUS: endoscopic ultrasound; CP: Chronic Pancreatitis; PANQOLI: PANcreatitis Quality Of Life Instrument

Table 4 : Comparison of malnourished with non-malnourished subjects

Category	Malnourished (n=18)	Non-malnourished (n=38)	p-value
Age (years)	50.6 ± 7.0	47.7 ± 10.1	p < 0.28
Gender	Male (33.3%) Female (66.7%)	Male (36.8%) Female (63.2%)	p <0.80
Race	Caucasian (83.3%) Black (11.1%) Hispanic (5.6%)	Caucasian (89.5%) Black (7.9%) Hispanic (2.6%)	p <0.78
Opiate Use (mg of oral morphine/day)	132.5 ± 110.1	122 ± 98.1	p <0.72
EUS Grading of CP	Mild (34.2%) Mild-Moderate (7.9%) Moderate (42.1%) Moderate-Severe (2.6%) Severe (13.2%)	Mild (16.7%) Mild-Moderate (5.6%) Moderate (61.1%) Moderate-Severe (11%) Severe (5.6%)	p <0.11
PANQOLI mean score	58.5 ± 16.9	55.1 ± 13.5	p<0.46

EUS: endoscopic ultrasound; CP: Chronic Pancreatitis; PANQOLI: PANcreatitis Quality Of Life Instrument

In terms of demographic data, there were significant differences between the chronic pancreatitis group and the control group. The control group was significantly younger, more racially diverse, and had far less narcotic and tobacco use (Table 2). Within the sub-groups, the only significant demographic difference was in the smoker group, who had a significantly younger mean age (45.8) compared to the non-smoking group (52). Please see tables 2-4.

IV. Discussion

This study presents an initial evaluation of the PANQOLI in chronic pancreatitis patients at a single tertiary medical center. Quality of life in chronic pancreatitis patients was most notably evaluated in the North American Pancreatitis Study 2 (NAPS 2), which evaluated 540 patients with chronic pancreatitis.16 443 of the 540 patients completed the Short Form-12 (SF-12), a instrument used commonly to evaluate quality of life, which gives a physical component and a mental component score. The NAPS 2 study found lower physical and mental component scores in the chronic pancreatitis group compared to a control population, which was consistent with other chronic diseases.17 The SF-12, however, is not a disease-specific instrument

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and primarily assesses the limiting effects of a disease. As quality of life entails a vast amount of factors such as depression, sleep, coping skills, and financial repercussions, the PANQOLI was developed to quickly assess in a single instrument the overall quality of life of patients with chronic pancreatitis.

As expected, this study revealed a significant difference in PANQOLI scores between the chronic pancreatitis population and the control population. The control population scored significantly higher, implying a higher quality of life, which is consistent with a healthy population. Furthermore, in terms of the sub-group analysis, there was a significant difference in PANQOLI scoring between the smoking and non-smoking groups. The non-smoking group scored higher on the PANQOLI than their counterparts which is not surprising considering that smoking would be expected to worsen quality of life.18-20

The main limitation of this study is the control group in this study, which consisted of medical students and residents. While this group represented a younger population with relatively few co-morbidities, it did not guarantee a healthy population.

In summary, this prospective study describes the initial use of the PANQOLI in a chronic pancreatitis population in an attempt to create a normal distribution. While displaying that these patients have a poorer quality of life compared to a control population, it also displayed worse quality of life in patients who smoke. This invites further studies to be done to evaluate quality of life differences in this sub-group and hints at the possibility of therapeutic interventions addressing this risk factor. In line with this, further validation of the PANQOLI may also allow for objective assessment of the holistic impact of interventions in this disease process using the PANQOLI.

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Comparing Health Indicators: Colombia and the OECD

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Abstract- Colombia has shown its intention to enter the OECD and during this process, it is important to compare its health indicators with the OCDE´s countries, taking in account not only the average results, but the differences according to regions, sex, ethnicity and income.

The methodology uses has been based on the OECD framework with a broad view of public health, including health status, non-medical determinants of health, health workforce, health care, quality of care, access to care, health expenditure, ageing and long-term care.

The main achievements of Colombia are universal coverage and low out-of-pocket payments. Colombia has some opportunities to show better health indicators due to a younger population, lower rates of diabetes and overweight and a low suicide rate compared with OECD countries.

Keywords: health indicators, OECD, colombia, morbility.

GJMR-K Classification: NLMC Code: W 84



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Comparing Health Indicators: Colombia and the OECD

Oscar Bernal [α], Diana Zamora [σ], Carlos Grijalba [ρ] & Anna Spector [ω]

Abstract- Colombia has shown its intention to enter the OECD and during this process, it is important to compare its health indicators with the OCDE´s countries, taking in account not only the average results, but the differences according to regions, sex, ethnicity and income.

The methodology uses has been based on the OECD framework with a broad view of public health, including health status, non-medical determinants of health, health workforce, health care, quality of care, access to care, health expenditure, ageing and long-term care.

The main achievements of Colombia are universal coverage and low out-of-pocket payments. Colombia has some opportunities to show better health indicators due to a younger population, lower rates of diabetes and overweight and a low suicide rate compared with OECD countries. Colombia needs to improve on equality by region, education and income, access and quality of care, mental health services, plus needs to reduce preventable mortality due to violence.

Keywords: health indicators, OECD, colombia, morbility.

I. Introduction

The Organization for Cooperation and Economic Development (OECD) is comprised of 34 countries around the world. Since 2010 Colombia has shown its intention to enter the OECD, with a formal request by President Santos and followed by a visit to the OECD. Admission to the OECD will allow the country to benefit from the work and experience in the formulation of public policy of the leading economies in the world (Ministerio Hacienda, 2012).

The Colombian Government will also have the opportunity to influence the design and adjustments of key instruments and initiatives to improve the functioning of the global economy and global governance (Gurria, 2013). OECD believes that the inclusion of Colombia is more a process than an event (OCDE, 2012) and as part of the process; the OECD will evaluate the application by Colombia of policies, practices and the legal instruments of the organization.

The OECD's report, Health at Glance, 2013, showed improvement in life expectancy and infant mortality, however inequalities in wealth, education and other social indicators still have a significant impact on health status (OCDE, 2013).

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Colombia and the OECD countries share common challenges such as the ageing of the population, an increase of non-communicable diseases, users who expect better treatments, and the exponential increase of health technology and pharmaceuticals. In some indicators Colombia has a lot to learn and work on to reach the average OECD level and in others Colombia has lessons learned to share with the OECD.

The goal of this analysis is to compare Colombian and OECD indicators, taking in account not only the average results, but the differences according to regions, ethnicity and income. Some of the data from the individual report providing health services has a 50% of under-reporting (ONS, 2014).

II. Methodology

We use the oecd framework with a broad view of public health including determinants of health and the OECD health care quality indicators project (kelley, 2006).

W e follow the same components of theOECD health analysis (OCDE, 2013), including health status, non-medical determinants of health, health workforce, health care, quality of care, access to care, health expenditure, ageing and long-term care.

The figures and data from the oecd were taken from its public data base (OCDE, 2015). the colombian indicators were taken from official government data from the ministry of health, the national health institute and the national statistics department. the oecd and colombian average data is un-weighted, unless otherwise specified. also, we used data from international institutions such as the world bank, cepal, and the international development bank. some definitions have been taken from the world bank such as, middle-income economies described as those with a gni per capita of more than $1,045 but less than $12,746 (world bank, 2015).

Indicators were evaluated according to methodology and scope in order to determine comparability with the indicators presented by the oecd report. we selected indicators including variables such as income and gender, using the free access databases of the OECD, attributing copyright ownership and adding colombian official data. most of the indicators used were from 2011 or the closest available year.

Some of the OECD indicators have no corresponding official data from colombia but in each of

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the areas it has been possible to identify some indicators.

III. Results

a) Health Status

OECD and colombia have been showing a tendency to increase the life expectancy, but the methodology used to measure it varies between countries. life expectancy has a tendency to rise in both the OECD countries and colombia; however the methodology varies between countries. Women in all countries had a higher life expectancy than men. women showed better results all the countries.

Life expectancy in colombia has increased from 64.7 (men) and 71.51 (women) in 1985 to 72.1 (men), 78.5 (women) in 2015. (ministerio de salud , 2013.) life expectancy in colombia is 4.2 years less than the average oecd countries. The life expectancy is 6 to 8 years higher among women though the difference between men and women could be reduced by 4 to 5 years by reducing deaths due to violence (ons, 2014). colombia has one of the highest homicide rate in the world 42.5 per 100 000 people in 2009, but is reducing compare with 65.8 in 1999, meanwhile salvador is increasing from 44,9 in 1999 to 62,9 in 2009 (ons, 2014).

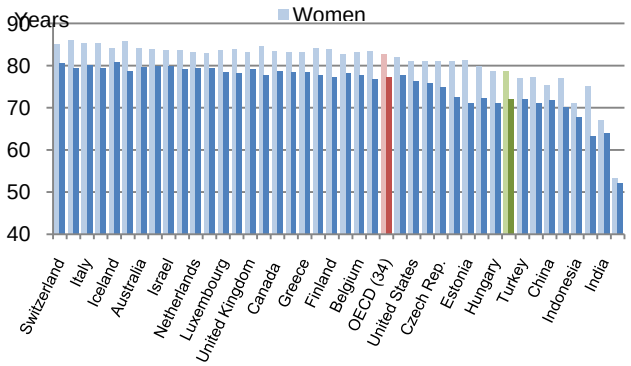


Figure 1 : Life expectancy at birth by sex, 2011 (or nearest year)

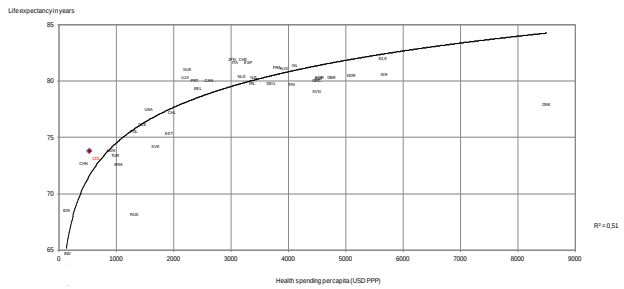


Figure 2 : Life expectancy Vs heath expenditure (USD PPP).

Colombia has important difference in life expectancy between regions being the highest in the capital (75.94 for men and 80.19 for women, and the lowest life expectancies concentrated in eight regions where life expectancy is less than 70 years: Chocó, Caquetá, Putumayo, Arauca, Casanare, Cauca, Meta and Amazonia) (Ministerio de Salud, 2013). There is no information relating life expectancy to level of education in Colombia.

Colombia has higher infant mortality rate compared with the OECD average (12.8 Vs 4.1), similar to China (12.6) and lower than Brazil (13.9). Many countries have reduced infant mortality in the past decades; Mexico reduced infant mortality from 77 in 1970 to 17 in 2010 and Colombia from 40 to 12.8 in the same period. In some large non-member countries (India, South Africa and Indonesia), infant mortality rates remain above 20 deaths per 1,000 live births (OECD, 2013).

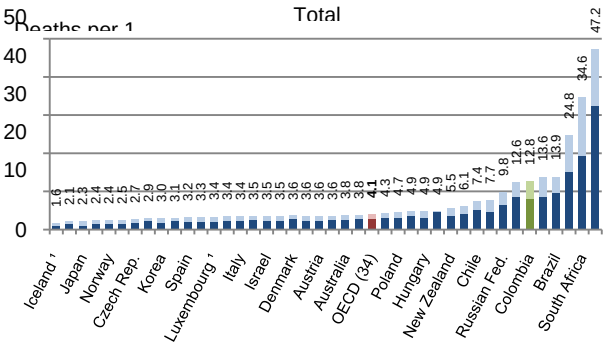


Figure 3 : Infant mortality Rates by country, 2011

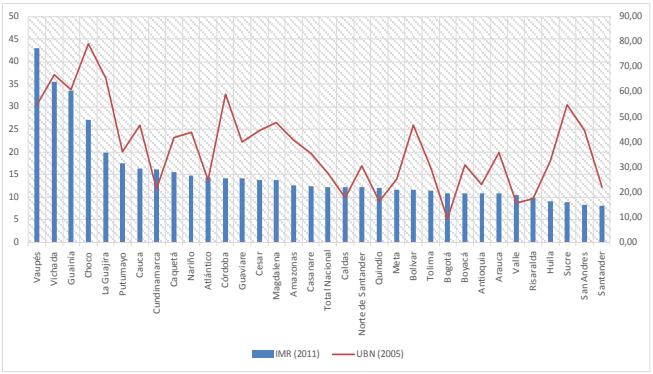


Figure 4 : Infant Mortality Rates and Unsatisfied Basic Needs by regions in Colombia 2011

In Colombia, between 2005 and 2011, the main causes of death in the general population were circulatory system diseases, though there has been a decline of this cause (from an adjusted rate of 166.43 to 146.16 deaths per 100,000 habitants). Cancer and external causes were the second and third cause of death, accounting for 17.42% (237,930) and 17.33% (236,679) of total deaths respectively from this period (Minsalud, 2013).

Mortality due to circulatory system diseases was 132.2 per 100000 inhabitants, ischemic disease, 263.7 per 100000 inhabitants, and cerebrovascular disease was 130.0 per 100000 inhabitants (PAHO,

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2010). This mortality is higher than the OECD average (122), similar to Iceland (133), lower than Hungary (309) and higher than Chile (70).

The average cancer mortality rate across OECD countries was 211 per 100,000 population in 2011, and the most recent data in Colombia, from 2009, was 120 per 100,000 population, lower than Mexico 138.1 and Brazil 2011, however the WHO has been estimated an under-reporting of 24% (PAHO, 2011) which would bring this rate to approximately 149 per 100,000 population.

Suicide rates were 5.0 deaths per 100, 000 inhabitants in Colombia (PAHO, 2010), similar to Greece, Turkey, Mexico, Brazil and Italy. In Korea, Hungary, the Russian Federation and Japan, suicide is responsible for more than 20 deaths per 100,000 people.

Fatalities due to car accidents in Colombia were 13,2 deaths per 100,000 lower than Mexico and Chile or Brazil and higher than Sweden, the United Kingdom and Denmark with four deaths or less per 100,000 people (Cendex, 2008).

6.8% of all newborns weighed less than 2,500 grams at birth. The proportion of low-weight births was the lowest in Nordic countries and Estonia, with less than 5% of live births defined as low birth weight. Colombia is showing an increasing tendency in the number of low-weight births, reaching 9,1 in 2010 (INS, 2014).

In almost all OECD countries, a majority of the adult population report their health as good. According to the health survey in Colombia, 72.2% reported their health as good (Rodriguez 2009).

In Colombia diabetes affects 5.2% of the population (Vargas 2011). Diabetes affected an average 6.9% of the OECD population aged 20-79 years, in Mexico, more than 15% of adults have diabetes, but only 5% of adults suffer from diabetes in Belgium, Iceland, Luxembourg, Norway and Sweden.

b) Non-medical Determinants of Health

In Colombia, current smoking in teenagers between the ages of 11 and 18 (prevalence in the last month) is 9.78%. Smoking among teenagers was 25% in Austria, the Czech Republic, and Hungary and less than 10% in Canada, Iceland, Norway, and the United States. (Cumsille, 2011)

Drunkenness is reported to have been experienced at least twice by more than 40% of 15-year-olds in the Czech Republic, Denmark, Estonia, Finland, Hungary, Slovenia and the United Kingdom. In Colombia, 40% students between the ages of 11 and 18 year- old reported alcohol consumption in the past month, but no data about Drunkenness was found. (Cumsille, 2011)

Overweight (including obesity) rates are approximately 23% for boys and 21% for girls, on average, in OECD countries. In Colombia it is 20.2% for overweight and 5.2% for obesity for boys and girls (Fonseca, 2011). Daily vegetable consumption was reported to be around 33% in girls and 25% in boys on OECD countries and only 13.5% in Colombia for boys and girls.

In OECD countries, less than 25% of the children reported regular training with moderate-to-vigorous exercise. Austria, Ireland, Spain, and Finland stand out as strong performers with over 30% of children reporting exercising for at least 60 minutes per day over the past week. In Colombia this figure was only 15% (Piñeros, 2010).

Vegetable consumption were less than 15% in India, South Africa, and Brazil. In Colombia 12,8%, similar to Sweden, Iceland and the United States and lower than the average OECD consumption (20%) (Rodriguez, 2009)

Alcohol consumption, as measured by annual sales, stands on average at 9.4 liters per adult per year across OECD countries and Colombia is 6,3 liters per adult per year higher than Costa Rica (3,9), Peru (3,7) y El Salvador (2,6) and lower than Mexico (8.9) (Sojo, 2012).

52.6% of the adult population in the OECD countries are reported as being overweight or obese. In Colombia 34.6% is overweight, including 16.5% obese (Fonseca, 2011). Obesity rates meanwhile vary widely in OECD countries from 4% in Japan and Korea, to over 32% in Mexico and the United States. The average vegetable intake across OECD countries was 64% for men and 73% for women while in Colombia it was only 19.6% per day (Fonseca, 2011).

c) Health workforce

The rate of doctors per 1 000 inhabitants in Colombia is 2, similar to Korea and lower than Greece with 6.1 doctors per 1 000 Inhabitants. Colombia has 13 obstetricians per 100 000 people (Cendex, 2008), lower than all the OECD countries. There are 3 psychiatrists per 100,000 (Rosselli, 2001), compared with 15.6 psychiatrists per 100 000 inhabitants on average across OECD countries, so Colombia has a lower number of mental health professionals.

There were two specialists for every generalist on average across the OECD countries in 2011. The slow growth in, or reduction of, the number of generalists raises concerns about access to primary care. In Colombia there is 1 specialist for every 10 generalists (Cendex, 2008), which would be impressive if it were not for the lack of empowerment of generalists to resolve most primary healthcare issues. The healthcare model continues to be based on specialists with poor implementation of primary health care.

Health care activity

The number of appointments per person ranged from over 13 in Korea and Japan, and over 11 in Hungary, the Czech Republic and the Slovak

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Republic, to three or fewer in Mexico, Sweden, South Africa and Brazil. In Colombia 71% of the population had at least one appointment in 2011, and the average was 1.5 appointments per person (ONS, 2011).

Japan and Korea had over nine hospital beds per 1000 people in 2011 while the average in OECD countries is 5. Colombia has 1.5 beds per 1,000 inhabitants (World Bank, 2012). The hospital stay was on average 4.5 days in OECD countries and in Colombia 3.3 (Ministry of Health, 2005).

In 2011, caesarean section rates were lowest in Nordic countries and the Netherlands, with rates ranging from 15% to 17% of all live births. Caesarean section rates were highest in Mexico and Turkey (over 45%), followed by Chile, Italy, Portugal and Korea (with rates ranging between 35% and 38%). Colombia had a dramatic increase in the number of Caesarean sections with 4.9% in 1998 soaring to 45.7% in 2013 (Rubio, 2014).

In Portugal, the generic market grew from virtually zero in 2000 to 30% in volume in 2011 and in Spain it grew up to 34%. In Colombia generics represented 17% in 2010 and has not shown a significant increase from 14% in 2007. (Econometría, 2011)

d) Quality of Care

Acute myocardial infarction mortality was low in Denmark (3%) while the highest rate is in Mexico (27%). In Colombia the mortality was 6,7% in 2005 (SILVA, 2006). Colombia reported an IMM rate of 60.9 per 100,000 in women and 93.4 per 100.000 in men showing a small reduction in comparison with 67.1 and 89.1 in 1990 respectively. (Revista Colombiana de Cardiología, 2010)

Across OECD countries, 8.5% of patients died within 30 days in the same hospital in which the initial admission for ischemic stroke occurred. The case-fatality rates were highest in Mexico (19.6%), Slovenia (12.8%) and Turkey (11.8%). Rates were less than 5% in Japan, Korea, Denmark and the United States. In Colombia this rate was 14%. (Zarruk, 2007)

Screening rates for cervical cancer range from 15.5% in Turkey to 85.0% in the United States. Austria, Germany, Sweden, Norway and New Zealand also achieved coverage above 75%. In Colombia 76,5% of the women are screened for cervical cancer. (Piñeros, 2007)

On average, in the OECD countries, 96% of children receive the recommended DTP vaccination and 94% receive measles vaccinations. Rates for DTP and/or measles vaccinations are below 90% only in Austria, Denmark, France, and South Africa. In Colombia the coverage is 93.5% (Minsalud, 2013), but some regions like San Andres have 62% coverage and Caldas 64% coverage, again exposing great differences by zone. The Human Papiloma Virus vaccine had 92% coverage for the second doses (Minsalud, 2013).

e) Access to care

Two OECD countries do not have universal health coverage. Mexico had 90% of the population covered and in the USA, 53% of the population is covered. Colombia reported 96% coverage in 2013; however this is not necessary equivalent to access to care. (Minsalud, 2014)

The number of doctors per capita varies widely across regions within the same country. A common feature in many countries is the trend for physicians to concentrate in capital cities. In Colombia, in cities with populations less than 20 000 don't reach 0.4 doctors per 10,000 inhabitants while in large cities it is 10 per 10,000. The use of medical services in Colombia is lower among the poor population, at 34%, compared with 47% among the non-poor (Profamilia, 2010).

In Colombia, the risk factors for the omission of cervical cancer screening include no insurance, affiliation to the subsidized healthcare regimen and low educational level. (Piñeros 2007) In breast cancer the risk factors were similar (De Charry, 2008). Income-related inequalities in cervical cancer screening are significant in 15 of the 16 countries in the OECD.

f) Health expenditure and financing

Colombia had the lowest expenditure compared with the OECD, with $466 USD Purchasing power parity (PPPs) compared with $ 3322 USD on average in the OECD , lower than Mexico ($977) or South Africa ($942). This expenditure is decreasing in countries such as Greece (-11.1) or Ireland (-6.6) and is increasing in countries such as Chile (9.3) and Colombia (World Bank, 2013).

In Colombia, total healthcare expenditure expressed as a percentage with respect to the GDP represents 6.5% for 2011, with a range from 5.4% in 2004 to 7.0% in 2009. The government's general expenditure as a percentage of GDP represents an average of 4.7%, Private expenditure as a percentage of GDP represents an average of 1.7% and the out-of-pocket expenditure 1.1%, representing 17% of the expenditures (Minsalud, 2014). Healthcare spending accounted for 9.3% of the GDP on average across OECD countries in 2011, compared with 9.4% in 2010.

g) Ageing and long-term care

On average across OECD countries, 4% of the population was 80 years old and over in 2010. By 2050, the percentage will increase to 10%. In Colombia, this population represented 1.4% of the total population in 2011 and will increase up to 1.5 % in 2020.

In Finland, France, Germany, Greece and Spain, only 35% to 40% of people aged 65 years and over rate their health as good. In Colombia 53.2% of people between 55 to 69 reported their health to be good (Profamilia, 2010).

France, Italy, Switzerland, Spain, Sweden and Norway had the highest prevalence rate of dementia,

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with 6.3% to 6.5% of the population aged 60 years. In Colombia 1.8% of 65 years old and 3.4% of 75 years old suffer of dementia.

On average across OECD countries, over 15% of people aged 50 and over provided care for a dependent relative or friend in 2010. Colombia has not comparable data, but 10.1% the population is define as disabled and among them 97% has been taken care by one member of the family (Urquieta, 2008).

IV. Discussion

The main achievements of Colombia compared with OECD countries are universal coverage and low out-of-pocket payments. Colombia has some opportunities to show better health indicators due to a younger population, lower rates of diabetes and overweight and a low suicide rate compared with OECD countries. Colombia needs to improve on equality by region, education and income, plus needs to reduce preventable mortality due to violence.

Similar studies were performed in some Latin American countries, such as as Chile and Mexico now members of the OECD. In one study from 2013, a comparison was taken from the health indicators in Chile with regard to those countries members of OECD; these studies yielded comparative data with higher indices in diabetes, obesity and suicide in comparison to countries from OECD being 6.9, 17.6 and 12.4 respectively. In addition, a greater out-of-pocket expenditure in health with 4.6% compared with the general average located at 2,86% (Ministerio de Salud Chile, 2013). Studies conducted in Mexico also demonstrate that diseases like diabetes have a higher prevalence, 10.8, compared with countries from the OECD which have 6.5, and with regard to obesity, countries from the OECD have rates of 16.9% while Mexico is 30%. With regard to total health expenditure, the country uses 6.4 % of PIB, well below countries from the OECD with 9.6 (Universidad de Mexico, 2013).

Comparing health expenditure by GDP, countries like Colombia and Mexico are situated at an intermediate level with 500 to 900 dollars per capita annually and Brazil, Costa Rica and Chile in the superior level, with more than one thousand dollars per capita annually (Castro, 2012). Latin American countries with incomes similar to Colombia; like Peru, a country with a per capita income of 6,661.6 (Banco Mundial, 2013-2014), showed the health expenditure per capita for Colombia was a little higher (617.89) than Peru 496.16 according to the Center for National Development Planning of Peru,. With regard to external resources (services offered by international organizations) Colombia received 09% in 2011 while Peru almost doubled that amount with 1.5% (Ceplan, 2014).

Some limitations to be considered in this work may be the result of not utilizing the same tools to measure indicators as well as the absence of data. In addition there is significant under-reporting especially from certain regions of Colombia. Finally, after assembling information regarding the health situation in Colombia, we suggest it is important to advance in quality topics and health service access, in addition to the use of family members as caregivers for the elderly. Last of all, health inequality in the different areas of the country is to be highlighted.

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Author's Participation

The Authors Have Been Involved In The Data Collection, Analysis, Writing And Correction Of This Paper.

Conflict Of Interest Statement

The authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest, or non-financial interest the subject matter or materials discussed in this manuscript.

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Ethical Consideration

This article use secondary data and does not imply any kind of intervention with people and according to the helsinki declaration has no risk.

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Intranasal Antifungal Therapy in Patients with Chronic Illness Associated with Mold and Mycotoxins: An Observational Analysis

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Abstract- Exposure to mycotoxin producing mold and mycotoxins can be associated with numerous adverse health consequences. We previously reported that patients with chronic illness frequently had a history of prior exposure to water damaged buildings (WDB) and mold. Additionally, the vast majority of these patients had mycotoxins present in the urine. We have postulated that the mycotoxin producing molds were likely harbored internally in the sinuses of these patients. In the present analysis, patients with chronic illness and a positive urine mycotoxin assay were treated with intranasal antifungal therapy, either amphotericin B (AMB) or itraconazole (ITR). AMB was associated with local (nasal) irritation adverse effects (AE) in 34% of the cases, which resulted in discontinuation. In patients that remained on therapy without AE, we found that 94% improved clinically. Additionally, we found that the urine mycotoxin levels decreased substantially in patients that improved on therapy. Similar findings were seen with ITR, however the number of patients treated was much smaller.

Keywords: toxic mold, mycotoxin, chronic fatigue syndrome, intranasal antifungal therapy.

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Joseph H. Brewer [α], Dennis Hooper [σ] & Shalini Muralidhar [ρ]

Abstract- Exposure to mycotoxin producing mold and mycotoxins can be associated with numerous adverse health consequences. We previously reported that patients with chronic illness frequently had a history of prior exposure to water damaged buildings (WDB) and mold. Additionally, the vast majority of these patients had mycotoxins present in the urine. We have postulated that the mycotoxin producing molds were likely harbored internally in the sinuses of these patients. In the present analysis, patients with chronic illness and a positive urine mycotoxin assay were treated with intranasal antifungal therapy, either amphotericin B (AMB) or itraconazole (ITR). AMB was associated with local (nasal) irritation adverse effects (AE) in 34% of the cases, which resulted in discontinuation. In patients that remained on therapy without AE, we found that 94% improved clinically. Additionally, we found that the urine mycotoxin levels decreased substantially in patients that improved on therapy. Similar findings were seen with ITR, however the number of patients treated was much smaller.

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I. Introduction

There has been a growing body of scientific literature indicating that exposure to mycotoxin producing molds and mycotoxins may be hazardous to the health of occupants of WDB (homes, schools and places of business) [1]. Water-damaged environments contain a mixture of biocontaminants produced by both mold and bacteria [1]. Secondary metabolites of molds (e.g. mycotoxins) have been identified in a variety of building materials and respirable airborne particulates, most commonly in WDB [2,3].

Using a sensitive and specific assay developed by RealTime Laboratories (RTL), we recently published a study linking the presence of aflatoxins (AT), ochratoxin A (OT) and/or macrocyclic trichothecenes (MT) to chronic fatigue syndrome (CFS) [4]. A significant number of these chronically ill patients were ill for many years, with average illness duration of more than seven years (range 2–36). Furthermore, over 90% of the patients gave a history of exposure to a WDB, mold or both. Exposure histories often indicated the WDB/ mold exposure occurred many years prior to the mycotoxin testing and furthermore, many of these patients did not report recent or current exposure to a WDB or moldy environment. Despite the remote history of exposure, these patients remained chronically ill and demonstrated the presence of significantly elevated concentrations of mycotoxins on urine testing. The persistence of illness years after exposure as well as the presence of mycotoxins suggested that there might be internal mold that represented a reservoir for ongoing internal mycotoxin production, either continuous or intermittent.

Recently we described the concept that the nose and sinuses may be the major internal reservoirs where the mold is harbored in biofilm communities [5]. This presence of mold can lead to the generation of mycotoxins internally. Thus, treatments aimed at reduction or elimination of the mold/fungi in the paranasal sinuses could lead to clinical improvement and in these patients. Herein, we present and discuss our observations in chronically ill patients who were treated with intranasal antifungal therapy.

II. Methods and Materials

a) Patients

All patients discussed herein had previously been diagnosed with CFS, similar to the patient population described in our previous study of mycotoxins in CFS [4]. Additionally, all were positive on the urine mycotoxin assay for at least one of the mycotoxins mentioned above. The age range of the patients reported and female to male ratio was very similar to the patient population previously published, in which the age range was 15 – 72 years and 75% of the patients were females [4].

The rationale for the treatment with intranasal antifungal therapy was outlined in our previous paper regarding the role of naso-sinus colonization with toxic mold [5]. The concepts relating to such therapy were discussed with these patients at the time of a clinic visit. In patients that wanted to proceed with therapy, a prescription was then sent to ASL Pharmacy (see below). The patients were typically seen in follow up within three to six months after initiating therapy. All patients reported herein were seen at least once in follow up after they started therapy.

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Institutional Review Board exemption was granted by Solutions IRB (Protocol #1FEB15-40). This was based on the fact that these patients were treated as part of their clinical management in the medical practice and not deemed to represent human subjects research.

b) Treatment

The therapy prescribed consisted of intranasal medications administered via an atomizer device. One agent was used to break up biofilm and the other an antifungal. Prescriptions were sent to ASL Pharmacy, Camarillo, California and then dispensed to the patients by ASL. The agents used to disrupt the biofilm consisted of a combination of ethylenediaminetetraacetic acid (EDTA) and a surfactant (polysorbate 80). Hereafter we will refer to that combination as the chelating agent (CHE). The CHE, which consisted of 2 milliliter (mL) of solution, was always given first, before the antifungal. The intranasal antifungal agents were either AMB or ITR. The AMB consisted of 5 mg in a solution of 3 mL. ITR consisted of 40 mg mixed in a solution of 4 mL. All intranasal applications were delivered via the Nasa Touch atomizer device provided to the patient by ASL Pharmacy. Patients generally administered the atomizer treatments once daily for each agent. The patients were advised to administer the CHE and respective antifungal separately (usually the CHE in the morning and the antifungal in the evening). Patients generally remained on therapy unless they discontinued it due to an AE. As discussed below, seven patients discontinued therapy unrelated to AE. The period of treatment observation ran for 12 months, May 2013 to May 2014.

c) Clinical Assessments

At the time of follow up clinic visits, each patient was asked to self-assess their improvement or lack thereof, that had occurred since starting therapy (compared to baseline symptoms before therapy). Improvements were categorized as: partial improvement (25% to 49% decrease in symptoms from baseline), moderate improvement (50% to 74% decrease in symptoms from baseline) or marked improvement (75% to 100% decrease in symptoms from baseline). The most common symptoms present at baseline and those commonly reported to improve on therapy were: fatigue, post-exertion malaise, body aching, headache and cognitive dysfunction. Since most patients had multiple symptoms, they were asked to make a global assessment as to whether they were overall improved from baseline and the degree (percent) of improvement. For purposes of the results reported in the Tables, the improvements (partial, moderate or marked) were grouped together. Thus, "improvement" represented at least a 25% or greater reduction in symptoms compared to baseline. Relapse was defined as recurrence of baseline symptoms after initial improvement.

At follow up, patients were also asked about AE that had occurred with the intranasal treatments. AE tended to be either local or systemic. Common local AE consisted of irritation symptoms in the nose and sinuses, to include: burning, congestion, nosebleeds, stuffiness, rhinorrhea and nasal/sinus pain. Systemic AE were always an exacerbation of baseline symptoms: fatigue (most common), headache, body aching and cognitive dysfunction. These were thought to be "die off" reactions (see below)

d) Mycotoxin testing

The urine mycotoxin testing of specimens were performed at RealTime Laboratories. The details of the assay have been previously described [4].

III. Results

During the 12-month period of observation, 151 patients initiated therapy with CHE and AMB. An additional 14 were treated with CHE and ITR. The clinical results for each group are summarized in Tables 1 and 2.

Table 1: Patients Treated with Amphotericin B (AMB

Group	Number	%
AMB Total Patients	151	100
AMB Clinical Response: Improved*	88	58
AMB Local AE Resulting in Discontinuation**	52	34
AMB Systemic AE Total (with or without Local AE)***	19****	13
AMB Continued Therapy & Improved	88	94

** Improvement defined in Methods section, **Local AE defined in Methods section, ***Systemic AE defined in Methods section, ****5 patients discontinued therapy due to systemic AE*

Table 2 : Patients Treated with Itraconazole (ITR)

Group	Number	%
ITR Total Patients	14	100
ITR Clinical Response: Improved*	8	57
ITR Local AE Resulting in Discontinuation**	1	7
ITR Systemic AE Total (with or without Local AE)***	3****	21
ITR Continued Therapy & Improved	8	80

**Improvement defined in Methods section, **Local AE defined in Methods section, ***Systemic AE defined in Methods section, ****all 3 patients discontinued therapy due to systemic AE*

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A subset of patients (n = 20) had repeat mycotoxin testing performed after several months on therapy. Of the 20 patients, 16 had been on AMB and 4 on ITR. Results of the repeat testing and clinical responses are summarized in Table 3. These patients continued on therapy, generally for greater than 6 months.

Additionally, seven patients, that had clinically improved, discontinued therapy (six from the AMB group and one on ITR). The most common reason given for discontinuation was that the patient felt as though they were probably "cured." These patients had repeat mycotoxin levels done while on therapy and another level after therapy had been discontinued. The data with regard to relapses and results of repeat mycotoxin levels after discontinuation of their treatments are seen in Table 4. In these patients, they had been on therapy at least 6 months when they discontinued the intranasal medication.

In summarizing the results from our patient observations, treatments with both AMB and ITR resulted in clinical improvement (reduction in symptoms).

In patients that used the AMB and remained on therapy without AE, 88 of 94 (94%) improved. Within this group, 26 of 88 patients (30%) graded their improvement as "marked" (defined above). We also found that AMB led to a decrease in the levels of mycotoxins in the urine assay.

Table 3 : Subgroup of Patients on Therapy with Repeat Mycotoxin Assays

Rx	Imp	%	AT dec	%	OT dec	%	MT dec	%	Total
AMB	14/16	88	4/4*	100	14/14*	100	11/15	73	16
ITR	3/4	75	1/1	100	3/4	75	3/4	75	4

*Rx: Treatment, Imp: improved, AT dec: aflatoxin level decreased, OT dec: ochratoxin A level decreased, MT dec: macrocyclic trichothecene level decreased, AMB: amphotericin B, ITR: itraconazole, *decreased down to a level of zero (AT 4/4, OT 14/14)*

Table 4 : Subgroup of Patients that Discontinued Therapy (after Improvement)

Rx	Imp	%	Relap	%	AT inc	%	OT inc	%	MT inc	%
AMB	6	100	5/6	83	n/a	n/a	3/4	75	4/4	100
ITR	1	100	1/1	100	n/a	n/a	1/1	100	1/1	100

Rx: Treatment, I: improved, Relap: clinical relapse after discontinuation, AT inc: aflatoxin level increased compared to level obtained on treatment, OT inc: ochratoxin A level increased compared to level obtained on treatment, MT inc: macrocyclic trichothecene level increased compared to level obtained on treatment, AMB: amphotericin B, ITR: itraconazole, n/a:not applicable

In the subset of patients on AMB (n = 16) that continued on therapy (generally at least 6 months) and had at least one repeat urine mycotoxin assay done, these repeat assays showed rather substantial and consistent decreases in the urine mycotoxin levels from baseline levels. AT (n = 4) and OT (n = 14) levels decreased in all cases tested and in all of these patients the levels dropped to zero. MT levels (n = 16) declined in 73%, albeit none dropped to zero. Several MT levels dropped rather dramatically, however, with levels as low as 0.01 ppb (data not shown).

Local AE in the nose and sinuses that resulted in discontinuation of therapy were common, seen in 34% of the patients on AMB. As noted above, systemic AE were not new symptoms, rather consisted of exacerbations of the patient's baseline symptoms. We felt these were most likely fungal "die off" reactions. These were frequently temporary, often lasting less than 3 to 4 weeks. However, in five AMB patients the systemic AE resulted in discontinuation. These systemic AE were not common, only seen in 13% of the AMB cases, albeit we suspect that these AE may have been under reported, given that a fairly high percentage of patients stopped therapy early due to local AE. AE that are reported with AMB, when administered intravenously, such as chilling, were not seen [6]. We did not see any systemic AE that were considered to be directly due to AMB [6].

ITR was quite effective, as well (albeit the numbers are much smaller). We noted clinical improvement in 80% of these cases. We also saw a decrease in mycotxin levels in ITR patients that had improved. Local AE were uncommon (less common that those seen with AMB). Systemic AE (presumably "die off") were seen with ITR but were uncommon.

We were also able to look at relapses in patients that had improved and elected to discontinue therapy. In seven patients that discontinued therapy (after improvement), six relapsed clinically (five on AMB and one that had received ITR). Most of these patients discontinued therapy around 6 months into the course of therapy. Furthermore, when mycotoxin levels were repeated after discontinuation of therapy (and relapse), the levels increased as compared to levels when on therapy (Table 4). OT levels increased after the patients stopped therapy in three of four cases. MT levels increased off therapy in four of four cases. When these patients resumed therapy (after discontinuation and

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relapse) their symptoms consistently improved again (data not shown).

IV. Discussion

Exposure to WDB, in particular, toxic mold, has been associated with numerous adverse health consequences [1,4]. We have studied patients with chronic illness, with the prototype being CFS. We found the chronic illness was highly associated with exposure to WDB/mold in the past and the ongoing presence of mycotoxins, detected with a sensitive and specific urine assay [4]. As we analyzed these patients, it became apparent that many of the patients with chronic illness and the presence of mycotoxins could trace their illness to past exposure but not recent or present exposure. We postulated that these patients may have harbored internal mycotoxin producing mold species and that such mold was likely in the sinuses, embedded in biofilm. A review of the literature and patient data supporting this idea was previously published [5]. Indeed, if these patients harbored mycotoxin producing molds/fungi in the sinuses, it seemed intuitive that therapies directed at reduction or elimination of this mold biofilm, could potentially lead to clinical improvements. Ponikau et al had previously found that fungi were very commonly found in the sinuses of chronic rhinosinusitis (CRS) cases [7]. This same group also showed that intranasal therapy with AMB had resulted in improvement in several clinical parameters in CRS patients [7]. Furthermore, AMB has been shown to be effective in fungal biofilm models [8]. Based on these types of data, we elected to offer treatment (intranasal AMB) to patients that were chronically ill (CFS) and had tested positive for mycotoxins.

We analyzed and report on 151 patients that initiated therapy with CHE and AMB, each administered once daily. Unfortunately, local AE in the nose and sinuses that resulted in discontinuation of therapy were common, seen in 34% of the AMB patients. These local AE were likely due to the irritation characteristics of AMB [6]. In patients that had minimal, if any local AE, the results were striking. We found that 94% of patients that continued on therapy (usually 6 months or longer) improved clinically. This was not particularly surprising given the prior published experiences with intranasal AMB in CRS cases, which frequently resulted in improvements in various clinical parameters (symptoms, endoscopic findings and computed tomography imaging results) [7]. Additionally, in our patients on AMB that improved and had repeat urine mycotoxin testing, we demonstrated substantial decreases in the urine mycotoxin levels from baseline levels. We have previously noted that repeat urine mycotoxin levels in patients that were not on any type of therapy did not significantly change from baseline levels (unpublished observations). The decreases in mycotoxin levels in the patients on intranasal AMB showed a very good correlation with clinical improvements. Systemic AE (presumably "die off" reactions) were not common but may have been under reported, as noted above. We suspect, in the patients reported herein, that the systemic "die off" reactions were due to enhanced mycotoxin release when the therapy was initiated, as a direct result of the AMB interacting with the mold/fungi in the sinuses. In an in vitro model, Reeves et al demonstrated increased synthesis and release of gliotoxin from Aspergillus fumigatus upon exposure to amphotericin B [9]. Other than the local AE and "die off" reactions, AE directly attributable to AMB were not seen. Ponikau et al tested the sera of 3 patients for AMB in CRS patients treated with AMB and found no detectable drug [7]. Thus, it appears that AMB has no systemic absorption from the nose or sinuses.

We also studied intranasal ITR. Initially, we were concerned that it may be less effective due to the reports of poor biofilm activity [8]. However, we tried ITR as an alternative therapy in a small group of patients (n = 14). Despite the in vitro data regarding limited biofilm activity, when given along with the CHE, ITR was quite effective, as well (albeit the numbers were much smaller). Since ITR is orally bioavailable, it is potentially absorbed from the nose and sinuses in the setting of intranasal therapy. Albeit relatively small doses of ITR are used with intranasal therapy, there is the possibility of AE from the drug directly since we assume it could be absorbed systemically from the sinuses.

Patients that had improved and discontinued therapy at approximately 6 months generally relapsed (six of seven patients). Furthermore, compared to the decreases in urine mycotoxin levels while on therapy, these levels increased after the patients had stopped their intranasal therapy. Thus, the duration of therapy remains a major question. Whether longer courses of therapy will be efficacious resulting in long term remissions remains unclear. It may be that some patients may need "maintenance" therapy to prevent relapses.

As stated earlier, the goal of intranasal antifungal therapy is reduction or elimination of the mycotoxin producing molds in the sinuses. From the data shown here, it appears that the mold levels in the sinuses can be reduced with intranasal therapy. It is unknown whether the mold can be eradicated.

V. Conclusions

Despite the local AE (particularly AMB) and relapses when therapy was discontinued, the success rate with intranasal therapy was very encouraging. One major obstacle was the intolerance with AMB secondary to local AE. This analysis of intranasal antifungal therapy directed at mycotoxin producing fungi and biofilm in the sinuses, offers a very promising therapy alternative for patients with chronic illness associated with mycotoxins

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VI. Future Directions

There remain a number of unanswered questions with regard to intranasal antifungal therapy in these types of patients. The agent of choice, proper dose, frequency of dosing, most effective way to administer the therapy and duration of therapy have not been fully elucidated. In view of the frequent local AE with AMB, other antifungal agents need to be addressed. Certainly, ITR is one available option, however, the potential for systemic absorption is a concern, as noted above. Another option is intranasal nystatin. Although used for decades as a topical agent for yeast infections, nystatin actually has good in vitro activity for molds [10]. Since nystatin is a polyene antifungal agent (similar to AMB), it would be predicated to have similar effects. Hopefully, there may be less local AE due to nasal irritation. Additionally, nystatin is not systemically absorbed and has a long track record of clinical safety. Intranasal nystatin was not available when this study was done. It may be a potential option to pursue.

There is also interest in alternative agents to break up the biofilm. In that regard, mupirocin has been studied in CRS patients and has been an effective therapy [11]. Additionally, mupriocin appears to be active against biofilm [12]. It may represent an interesting agent to address for these types of patients in the future.

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Data and Edits in Healthcare Information Management

By Sajeesh Kumar

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Abstract- This studydetermine which job function causes or creates a large number of Edit/ Data Overwrites within health care. The study is based on data extracted from the Monthly Reports reported by the Team staff. Out of the 2736 Potential Identity Changes, 115 actually resulted in a CE. The number of CEs created by each job title ranged from 1% by Employee Health Clerk to 28% by Eligibility Clerk. Out of the 115 CEs created, a total of 32 were created by the Eligibility Clerks. The next highest job title was the Enrollment/Registration Clerks with 21 CEs created. Of the 4% of CEs reported, Eligibility Clerks created 28% of those CEs and Enrollment/Registration Clerks created 18% of CEs reported during this time period. The findings provide insight to thestaff as well as other managers for the users who need additional training or realignment in the workflow. Further work is required to expand and identify factors contributing to incidents causing CEs.

Keywords: *data; edits, health informatics.*

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DATAANDEDITSINHEALTHCAREINFORMATIONMANAGEMENT

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Keywords: *data; edits, health informatics.*

I. Data and Edits in Healthcare Information Management

There has been a significant increase in the number of occurrences of catastrophic edits to patient identity traits. Catastrophic Edit (CE) are changes to a patient's electronic health record that result in the record being changed to that of another patient, caused by, but not limited to, edits to patient identity data (such as name, Social Security Number (SSN), date of birth, gender) and/or erroneous merging of two or more distinct patient records into a single record.

While monitoring the changes, it has beendiscovered a recurring issue of catastrophic edits to patient identity traits. These edits are often a result of an inappropriately editing of an existing record through mis-selection or error. These errors can affect administrative, clinical, and billing processes as well as affect patient care causing a significant patient safety risk.

The purpose of this study is to investigate the role (job title) of the originator of the Catastrophic Edits/Data Overwritesto identify the correlation between the role and the number of Catastrophic Edits. The objective of this study is to determine which job function causes or creates a large number of Catastrophic Edits/ Data Overwrites.

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II. Background

There are several studies and researches conducted that focuses on the patient safety incident involving human computer related incidents. Magrabi, Ong, Runciman, & Coiera's (2010) conducts a descriptive analysis to examine computer related patient incidents across one Australian state. Ash, Berg&Coiera, 2003 draws on a series of qualitative research studies in the US, the Netherlands and Australia with ethnography observation in healthcare setting and semi-structured interviews with health professionals.

Magrabi, Ong, Runciman, & Coiera (2010) searched 42616 patient safety events incident reported 2003 to 2005 by public hospital clinician to the Advanced Incident Management System. They examined 123 incidents that were computer related incident. Of the 123 incidents retrieved, four duplicates and eight incidents that did not relate to patient safety were removed, leaving 111 incidents. Of the 111 incidents, eight were described as an improvement in patient safety due to Information Technology (IT) and four were unresolvable, leaving 99 incidents. Information input issues accounted for the largest category with 31% of the incidents. These issues included were related incorrect human data entry such as incorrect selection of patient and typographical errors. Information output data accounted for 20% of incidents, which included problems with human-computer interaction such as error in interpreting, printed information due to poor quality or data retrieval errors (Magrabi, Ong, Runciman, & Coiera, 2010).

Ash, Berg and Coiera (2003) discussed errors in the process of entering and retrieving information in or from the system based on ethnographic observations and semi-structured interviews with healthcare professionals. They discussed in detail the problem of a human-computer interface that is not suitable for a highly interruptive use context. By health care professional often being interrupted by patients, telephones and other colleagues, the mismatch between interface and use context often resulted in a juxtaposition error. A juxtaposition error is an error caused when something is close to something else on the screen and the wrong option is too easily clicked in error (Ash, Berg and Coiera, 2003). The authors found there were instances of patient confusion when orders were entered for the wrong patient. They also found that

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overly structure data entry led to a loss of cognitive focus. The use of many screens or need to switch between screens results in error.

III. Methods

This study examined Catastrophic Edits (CEs) reported by team staff between November 2011 through December 2012. Due to privacy and security policies, the sites and CEs have been de-identified. The role or functional job title of the medical center staff who createdthe CE options consists of the following job titles: Administrator of the Day (AOD), Clinic Clerk, Clinical (Medical/Surgical) Staff, Eligibility Clerk, Employee Health Clerk, Enrollment/ Registration Clerk, Health Eligibility Center (HEC) Staff, Point of Contact (POC), Personnel/Human Resources (HR) Clerk, Privacy Officer, Supervisors, Ward Clerk and Other. The options for how the CE occurred include: Manual, Primary View Updates, Catastrophic Merge, Upload, and unknown, Mismatch/Auto Link.

The data collected from the Monthly CE Reports was compiled using Microsoft Excel. The data was extracted and entered in separate MS Excel worksheets. The data extracted was entered in MS Excel worksheets and categorized by titles of the originator, sites, and how the CE occurred. The number of CEs created and the job title of the creator of the CE were calculated and a bar graph was formulated to identify the actual number of CEs created by each job title. The number of CEs were calculated and a bar graph was formulated to identify the number of CEs. The number potential CEs calculated against the number of actual CEs each month was charted and a bar graph was formulated to compare the potential CEs vs. the actual CEs.

IV. Results

From November 2011 to December 2012, a total of 2736 Potential Identity Changes occurred. Out of the 2736 Potential Identity Changes, 115 actually resulted in a CE (Table 2). Table 3 shows the job title of the CE originator in ascending order by the number of CEs created. The number of CEs created by each job title ranged from 1% by Employee Health Clerk to 28% by Eligibility Clerk. Out of the 115 CEs created, a total of 32 were created by the Eligibility Clerks. The next highest jobtitle was the Enrollment/Registration Clerks with 21 CEs created. The MPI POCs and the other job title ranked close with MPI POCs creating 15 CEs and Other creating 16 CEs. The Employee Health Clerks created the lowest number of CEs with 1 CE created followed by the AOD with 2 CEs and Regional Office Staff with 3 CEs. There is a significant difference between the job titles which created the highest number of CEs created compared to the job title which lowest number of CEs.

Table 2 : Total Potential ID Change and Edits

	Total Potential ID Changes	Total Catastrophic Edits
	80	10
	87	8
	90	9
	82	8
	92	4
	103	12
	100	6
	359	8
	344	13
	352	8
	715	4
	158	5
	79	17
	95	3
Total	2736	115

Table 3 : Job Title of Edits Originators

TITLE OF CE ORIGINATOR	CEs Created	% of CEs Created
Admin Officer of the Day (AOD)	2	2%
Clinic Clerk	8	7%
Clinical (Medical/Surgical) Staff	4	3%
Eligibility Clerk	32	28%
Employee Health Clerk	1	1%
Enrollment/Registration Clerk	21	18%
Health Staff	6	5%
MPI	15	13%
Other	16	14%
Supervisor	7	6%
Regional Office Staff	3	3%
Total	115	

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V. Discussion

In this study various tools were used to examine the role or functional job title of the medical center staff that created the CE on the MPI. The findings reveal that out of the number Potential Identity Changes, 4% actually resulted in a CE, which is considered relatively high compared to the medical staff's goal of creating less than 1% of CEs. This study found that the job titles with the highest occurrence of CEs are Eligibility Clerks and Enrollment/Registration Clerks.

There wereseveral limitations to this study.These finding may be less applicable to other health care institutions or users that edits data within records. Another limitation was in cases where the job title of the CE was undetermined or unknown, the CE was documented and counted in the "Other" section for this study. This may have caused underrepresentation of the job title of the user who created the CE.Lastly, the Catastrophic Edit report used to examine the CEs that have occurred may contain errors or inaccuracies in documentation.

VI. Conclusion

Of the 4% of CEs reported, Eligibility Clerks created 28% of those CEs and Enrollment/Registration Clerks created 18% of CEsreported during this time period. Eligibility Clerks and Enrollment/Registration clerks work in a high traffic multifunctional work environment that results in errors caused by mis-clicking, interruptions, entering and retrieval of wrong patient. According to Magrabi, Ong, Runciman & Coiera, most information input problems were associated incorrect data entry such as incorrect selection of the patient name, data entry in incorrect fields and typographical errors. Factors reported included lack of training, failure to carry out a duty, high cognitive workload and effects of multitasking (2010). The findings of this study produced useful information about the users to which yieldsto further research with identifying various causes of CEs.Since this study did not evaluate the actual causes of the CEs, further work is required to expand and identify factors contributing to incidents causing CEs.

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Table 1: Edits Reports

VISN	HOW CE OCCURRED (Manual, etc.)	TITLE OF CE ORIGINATOR
F	Manual	Admin Officer of the Day (AOD)
F	Manual	Admin Officer of the Day (AOD)
H	Manual	Clinic Clerk
H	Manual	Clinic Clerk
I	Manual	Clinic Clerk
J	Manual	Clinic Clerk
J	Manual	Clinic Clerk
L	Manual	Clinic Clerk
L	Manual	Clinic Clerk
U	Manual	Clinic Clerk
G	Manual	Clinical (Medical/Surgical) Staff *
K	Manual	Clinical (Medical/Surgical) Staff *
U	Manual	Clinical (Medical/Surgical) Staff *
V	Manual	Clinical (Medical/Surgical) Staff *
A	Manual	Eligibility Clerk

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A	Manual	Eligibility Clerk
A	Manual	Eligibility Clerk
A	Manual	Eligibility Clerk
D	Manual	Eligibility Clerk
F	Manual	Eligibility Clerk
F	Manual	Eligibility Clerk
G	Manual	Eligibility Clerk
G	Manual	Eligibility Clerk
G	Manual	Eligibility Clerk
G	Manual	Eligibility Clerk
H	Manual	Eligibility Clerk
H	Manual	Eligibility Clerk
I	Manual	Eligibility Clerk
I	Manual	Eligibility Clerk
I	Manual/Mismatch	Eligibility Clerk
K	Manual	Eligibility Clerk
P	Manual	Eligibility Clerk
P	Manual	Eligibility Clerk
P	Manual	Eligibility Clerk
P	Manual	Eligibility Clerk
Q	Manual	Eligibility Clerk
Q	Manual	Eligibility Clerk
R	Manual	Eligibility Clerk
R	Manual/Mismatch	Eligibility Clerk
R	Manual	Eligibility Clerk
S	Manual	Eligibility Clerk
T	Manual	Eligibility Clerk
T	Manual	Eligibility Clerk
T	Manual	Eligibility Clerk
U	Manual	Eligibility Clerk
V	Manual	Eligibility Clerk
T	Manual	Employee Health Clerk
C	Manual	Enrollment/Registration Clerk
C	Manual	Enrollment/Registration Clerk
D	Manual	Enrollment/Registration Clerk
D	Manual	Enrollment/Registration Clerk
F	Manual	Enrollment/Registration Clerk
F	Manual	Enrollment/Registration Clerk
G	Manual	Enrollment/Registration Clerk
H	Manual	Enrollment/Registration Clerk
H	Manual	Enrollment/Registration Clerk
H	Manual	Enrollment/Registration Clerk
H	Manual	Enrollment/Registration Clerk
H	Upload	Enrollment/Registration Clerk
I	Manual	Enrollment/Registration Clerk
J	Manual	Enrollment/Registration Clerk
L	Manual	Enrollment/Registration Clerk
O	Manual	Enrollment/Registration Clerk
P	Manual	Enrollment/Registration Clerk
T	Manual	Enrollment/Registration Clerk
U	Manual	Enrollment/Registration Clerk
W	Manual	Enrollment/Registration Clerk
R	Manual	Enrollment/Registration Clerk (DoD)
G	Manual	HEC Staff
G	Manual	HEC Staff
G	Manual	HEC Staff
G	Manual	HEC Staff
G	Manual	HEC Staff
G	Manual	HEC Staff

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C	Manual	MPI POC
C	Manual	MPI POC
D	Manual	MPI POC
G	Manual	MPI POC
G	Manual	MPI POC
J	Manual	MPI POC
K	Catastrophic Merge	MPI POC
K	Manual	MPI POC
P	Catastrophic Merge	MPI POC
R	Manual	MPI POC
R	Manual	MPI POC
T	Manual	MPI POC
T	Manual	MPI POC
T	Manual	MPI POC
W	Manual	MPI POC
A	Manual	Other *
D	Manual	Other *
G	Mismatch/Auto-Link	Other *
I	Manual	Other *
P	Manual	Other *
P	Upload	Other *
P	Upload	Other *
P	Upload	Other *
P	Upload	Other *
P	Upload	Other *
P	Upload	Other *
P	Upload	Other *
P	Upload	Other *
P	Upload	Other *
P	Upload	Other *
U	Manual	Other *
A	Manual	Supervisor
G	Manual	Supervisor
K	Manual/Catastrophic Merge	Supervisor
T	Manual	Supervisor
U	Manual	Supervisor
W	Manual	Supervisor
W	Manual	Supervisor
J	Manual	Regional Office Staff
T	Manual	Regional Office Staff
W	Manual	Regional Office Staff

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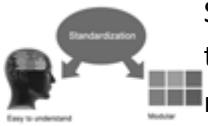


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(b) A brief Summary, "Abstract" (less than 150 words) containing the major results and conclusions.

(c) Up to ten keywords, that precisely identifies the paper's subject, purpose, and focus.

(d) An Introduction, giving necessary background excluding subheadings; objectives must be clearly declared.

(e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition; sources of information must be given and numerical methods must be specified by reference, unless non-standard.

(f) Results should be presented concisely, by well-designed tables and/or figures; the same data may not be used in both; suitable statistical data should be given. All data must be obtained with attention to numerical detail in the planning stage. As reproduced design has been recognized to be important to experiments for a considerable time, the Editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned un-refereed;

(g) Discussion should cover the implications and consequences, not just recapitulating the results; conclusions should be summarizing.

(h) Brief Acknowledgements.

(i) References in the proper form.

Authors should very cautiously consider the preparation of papers to ensure that they communicate efficiently. Papers are much more likely to be accepted, if they are cautiously designed and laid out, contain few or no errors, are summarizing, and be conventional to the approach and instructions. They will in addition, be published with much less delays than those that require much technical and editorial correction.

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It is vital, that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

Format

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Standard Usage, Abbreviations, and Units: Spelling and hyphenation should be conventional to The Concise Oxford English Dictionary. Statistics and measurements should at all times be given in figures, e.g. 16 min, except for when the number begins a sentence. When the number does not refer to a unit of measurement it should be spelt in full unless, it is 160 or greater.

Abbreviations supposed to be used carefully. The abbreviated name or expression is supposed to be cited in full at first usage, followed by the conventional abbreviation in parentheses.

Metric SI units are supposed to generally be used excluding where they conflict with current practice or are confusing. For illustration, 1.4 l rather than 1.4 × 10-3 m3, or 4 mm somewhat than 4 × 10-3 m. Chemical formula and solutions must identify the form used, e.g. anhydrous or hydrated, and the concentration must be in clearly defined units. Common species names should be followed by underlines at the first mention. For following use the generic name should be constricted to a single letter, if it is clear.

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Many researchers searching for information online will use search engines such as Google, Yahoo or similar. By optimizing your paper for search engines, you will amplify the chance of someone finding it. This in turn will make it more likely to be viewed and/or cited in a further work. Global Journals Inc. (US) have compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Key Words

A major linchpin in research work for the writing research paper is the keyword search, which one will employ to find both library and Internet resources.

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Search engines for most searches, use Boolean searching, which is somewhat different from Internet searches. The Boolean search uses "operators," words (and, or, not, and near) that enable you to expand or narrow your affords. Tips for research paper while preparing research paper are very helpful guideline of research paper.

Choice of key words is first tool of tips to write research paper. Research paper writing is an art.A few tips for deciding as strategically as possible about keyword search:

- One should start brainstorming lists of possible keywords before even begin searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in research paper?" Then consider synonyms for the important words.
- It may take the discovery of only one relevant paper to let steer in the right keyword direction because in most databases, the keywords under which a research paper is abstracted are listed with the paper.
- One should avoid outdated words.

Keywords are the key that opens a door to research work sources. Keyword searching is an art in which researcher's skills are bound to improve with experience and time.

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Acknowledgements: Please make these as concise as possible.

References

References follow the Harvard scheme of referencing. References in the text should cite the authors' names followed by the time of their publication, unless there are three or more authors when simply the first author's name is quoted followed by et al. unpublished work has to only be cited where necessary, and only in the text. Copies of references in press in other journals have to be supplied with submitted typescripts. It is necessary that all citations and references be carefully checked before submission, as mistakes or omissions will cause delays.

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28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. Think technically: Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

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33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

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Key points to remember:

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· Use paragraphs to split each significant point (excluding for the abstract)

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· Present your points in sound order

· Use present tense to report well accepted

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- Significant conclusions or questions that track from the research(es)

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- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
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Approach:

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- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

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The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.



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Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

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Approach

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- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
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References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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