Title Page

Developing a shared decision support framework for aortic root surgery in Marfan syndrome

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Structured Abstract
(Words 249/250)

Objective:
The study is the second phase of three in development of a decision support framework for people with Marfan syndrome anticipating prophylactic aortic root. Implications of the timing and the nature of the operation chosen were previously elicited in focus groups. In this second phase we explored the range of relative values placed by individuals on the implications of the decisions.

Methods:
Following the principles of the Ottawa Decision Support Framework eight questions in the general form "How important is it to you …" were framed by a mixed panel. Marfan people, families, and specialist doctors answered on line. Quantitative and qualitative analyses were performed.

Results:
World-wide 142 responses were received including 25 specialist doctors. Respondents were 55% female and 46% had previous aortic root surgery. Overall, active life style was more important to males (P=0.03). Patients placed more importance than doctors on not deferring surgery (P=0.04) and on avoidance of anticoagulation in the interests of child bearing (P=0.009). Qualitative analysis showed differing but cogently reasoned values which were sometimes polarised, and mainly driven by the wish to maintain a good quality of life and active lifestyle.

Conclusions:
Given the cogency of these view-points, people anticipating root replacement surgery should have ample opportunity to express them, and to have them acknowledged ahead of a consultation when they can then be fully explored in a mutually informed forum. If they are at odds with authoritative medical advice, they can then be discussed in the process of reaching shared individualised decisions.

What is already known about this subject?
The threshold dimensions and other factors determining the timing of elective surgery for congenitally determined aortic root aneurysms are the subject of well-developed clinical guidelines largely devised and implemented by medical professionals.

What does this study add?
Using the Ottawa Decision Support Framework we have explored how patients' preferences for timing of an intervention and the consequences of choosing valve sparing or valve replacing strategies can be elucidated prior to a decision making consultation.

How might this impact on clinical practice?
Patients with these conditions are frequently within families who share the condition and belong to patient associations. They have knowledge and experience of the implications of the timing and choice of operation and their satisfaction with care might be improved if this were more recognised, respected and used in the making of decisions with lifetime consequences for them.

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Introduction

Prophylactic surgery to prevent dissection in congenitally determined aortic root aneurysms is well established. Clinical decision making in this context is related to both the timing of the surgery and the surgical approach. The timing of surgery depends largely on the size of the aorta and its growth rate; for many patients living with the possibility of dissection of their enlarged may negatively affect their quality of life. The surgical approach that is chosen to prevent dissection may also affect patient quality of life and is value sensitive. The more durable mechanical replacement includes thromboembolic hazard plus the risk of iatrogenic bleeding. The avoidance of those risks with valve sparing surgery carries a substantial life-time risk of valve failure, consequential loss of well-being and a high likelihood of further surgery.[1;2] Some patients may prefer a durable solution and accept the burden of anticoagulation when mechanical replacement is chosen, others may prefer the less durable approach of valve sparing surgery to avoid anticoagulation.

Given the complexity and the value-sensitive nature of the decisions that are required in this setting, there is need for an evidence-based decision support framework to optimize the decision making process. The Ottawa Decision Support Framework (ODSF) offers an evidence-based, practical, mid-range theory for guiding patients making health or social decisions (insert ref ODCF). The ODSF uses a three-step process to: 1. assess client and practitioner determinants of decisions to identify decision support needs; 2. provide decision support tailored to client needs (counselling, decision tools such as patient decision aids, decision coaching) and 3. evaluate the decision making process and outcomes. A recent randomized trial in patients requiring heart valve replacement showed that although the use of a decision aid that was built using the ODSF to support prosthetic valve selection did not result in less decisional conflict, it did result in better patient knowledge of heart valve prostheses, patients feeling better informed, less anxious and depressed, and a better mental quality of life at the time of the decision making (insert ref Korteland Circ CVQO 2017).

Focus groups have previously indicated that patients with Marfan syndrome and related disorders want to understand the alternatives they have in the complex decision making they are facing, and voice their preferences[4] . The purpose of this study is to explore what patient and physician preferences for timing of an intervention and the consequences of choosing valve sparing or valve replacing strategies are, as a starting point for developing a ODSF decision support instrument which could be used to set the context of conversations with patients with the purpose of making shared decisions.

Methods

Already identified in focus groups were the themes that most concerned people who had had aortic root surgery.[4] These concerned the timing of surgery, leading an active life-style, commitment to anticoagulation, preferences with respect taking medicines and attending hospital for monitoring. There were specific concerns that would create an impediment to one or other operation for some people, such as the wish for a pregnancy and the avoidance of heart valve noise.

Questions were framed in the style of the Ottawa Decision Support Framework (ODSF)[7;8] and were developed by a panel with a range of expertise, knowledge and first-hand experience of Marfan syndrome and aortic root surgery. (Table 1) Eight questions were presented with 1-10 Likert scale, each accompanied by a free text box inviting patients to write down any thoughts prompted by the question. (Web extra: questionnaire)

We were advised by the Integrated Research Application System (IRAS)[i] that formal application was not required for this study which was to be circulated by the Marfan Association (UK) to its members. People with Marfan syndrome, their families and specialist doctors were invited to view the survey via a web link and to participate only if they wished to do so, and to send on the link to any of their own contacts. The respondent had to actively open the electronic form, could leave it at any time, and it was only saved with their final confirmation. They were asked to indicate which of five categories they fitted:

1. I may require an aortic root operation at some point in the future.
2. An aortic root operation is actively being considered for me.
3. I have had an aortic root operation.
4. This decision affects a member of my family.
5. I am a medical practitioner.

They were allowed to tick as many as applied, asked to indicate their age and gender, and to add further comments.

There were three planned comparative analyses: Male *versus* Female; Patients and Families *versus* Doctors; Patients anticipating root surgery *versus* patients who had already undergone root surgery.

Statistical analysis: Continuous variables were displayed as median, IQR and range. Discrete variables were displayed as counts or proportions. IBM SPSS Statistics 21 was used for all statistical analyses. Comparison between continuous variables was by Student's T-test. Comparison of group responses to the questionnaire was by independent samples Mann-Whitney U-test.

The free text answers were analysed using two steps: firstly, free text answers were thematically coded to explore the range of experiences and perspectives of the preferences and choices in the study, using the 'Framework' approach [9] through the NVivo qualitative

analysis programme. The analysis involves six key stages: familiarization; identifying; a thematic framework; indexing; charting; mapping and interpretation. 'Framework' allows combining exploring pre-determined topics (given through the questions) with more open and emerging themes in the free text answers. In a second step, the resulting themes were then further explored by mapping them against the main outcomes of the study results with a view to contextualising numerical responses to the questions.

Table 1. The eight questions.

1	How important is it to you to postpone having an operation on your aorta for as long as the doctors think it is safe to do so?
2	How important is it to you to avoid taking anticoagulant (blood thinning) medication?
3	How important is it to you, if you need to have an operation on your aorta, to get on with it and have it behind you?
4	How important is it to you to avoid lifelong medication such as beta blockers or losartan?
5	How important is it to you to avoid repeated visits to the hospital for tests?
6	How important is to you to have a physically active lifestyle?
7	How important is it to you to avoid anticoagulation which might be an obstacle to having a baby? (Men may answer.)
8	How important is it to you to have no noise from your heart valve?

Legend to Table 1: For the purposes of the study these questions were set out as a web form. In clinical practice this could be presented to the patient (paper or electronic) to take home with sufficient time and space to write in their reflections. It would then be a document for discussion, representing a personal profile of the values brought to the consultation, based on whatever prior knowledge, experience or assumptions the patient might have. For the format of the questionnaire see the web supplement.

Results

There were 142 respondents. The geographical distribution is shown in Figure 1. Of the 142 there were 10 respondents who selected two categories and two who selected three categories. Age and sex distributions by category are shown in Table 2. The age distributions included all patients who had indicated that particular category.

Table 2. Respondent characteristics (N=142)

	N=142 individuals
Age years median (IQR) (range)	52 (30-65) (12-74)*
Gender	
Female *Male*	64 (54.9%) 78 (45.1%)
Respondent type†	N and % of 156 respondents
1. *May require a future aortic root operation*	40 (28.2%)
2. *Active consideration of aortic root operation*	5 (3.5%)
3. *Had an aortic root operation*	65 (45.8%)
4. *Decision affects a member of my family*	21 (14.8%)
5. *Medical practitioner*	25 (17.6%)

Legend to Table 2.

*Three respondents did not provide their date of birth.

† Twelve individuals entered more than one category: [1,2,4]x2; [1,2]x1; [1,4]x2; [1,5]x1; [3,4]x5; [3,5]x1. The duplicate and triplicate ages were retained in each group for analysis of the age distributions.

Of the total 119 people with Marfan syndrome (including two doctors) there were 58 males and 61 females. The women responding were (significantly) younger than the men (mean 45 (SD:14) versus 52 years (SD:15). There was no significant correlation between age and the distribution of the study responses (Pearson's correlation coefficient).

Of 32 bar charts the eight comparing the responses of males and female (Figs.2) and those comparing medical and non-medical responses (Fig.3) have been presented in the main paper. The full set are in the Supplement. There was a strong degree of importance attached to maintaining an active lifestyle by all groups. Men and women put similar importance on avoiding anticoagulation in the interests of pregnancy. (Fig.2) Patients weighted the importance on getting aortic surgery behind them rather more highly than did their doctors. (Fig.3)

Results of Qualitative analysis.

Recurring themes (Table 3) were identified as

- maintaining as normal a life as possible,
- preserving a good quality of life in living with Marfan syndrome and
- retaining an active and participatory lifestyle.

In relation to the three dominant themes identified, maintaining an active life style was the one highlighted by doctors as a decisive factor. It may be that the value placed on remaining active, especially physically active, is most accessible to the outside view. Preserving a normal life for as long as possible was also invoked in the decision to *delay* aortic root surgery.

Commentary in favour of delay included considerations of risks of the procedure and outcome; recovery from the operation; current (good) health; and the current life course status, such as having a young family, existing work/study commitments.

Respondents in favour of having the procedure sooner rather than later commented on the disruption and levels of anxiety experienced in waiting for the procedure and the uncertainty delay posed to moving forward with one's life. The preferences and sometimes strong views offered in the study were tempered by a sense of pragmatism in dealing with some of the treatments that come with the management of Marfan syndrome.

When considering whether or not to postpone surgery, most of the doctors took the view that surgery should only be conducted when it became medically necessary because of the risks of the surgery itself, hence taking quite a conservative approach to surgery. The exception to this was the view of one doctor, who made the case for earlier surgical intervention "Fix the problem may signify return to normal life".

A fuller qualitative analysis is provided as a supplement.

260 Table 3. Recurring themes: examples of free answer texts

Themes in responses	Quotes from people living with Marfan	Quotes from doctors
Maintaining as normal a life as possible	"I'd rather get it over and done with rather than have it hanging over my head as some dreaded event in the future" (Respondent 131, male, age 64). "My aneurism has been stable. I don't feel myself at all in danger. To have a surgery will change my life." (Respondent 40, male, age 40) "Having known I would need surgery from a fairly young age, as the time passed, I just wanted the surgery done so I could get on with my life." (Respondent 45, female, age 25) I want to live as 'normal' a life as possible, I feel being on long term medication, would not help in this aim." (Respondent 27, female, 53)	"I am reluctant to recommend early intervention if there is not a clear indication (there is a risk of over-treatment)" (Respondent 38, doctor) "Taking life time medication not important unless there are important adverse effects (e.g. impotence)" (Respondent 8, doctor)
Preserving a good quality of life	"Take the medicine and live a reasonably good life or do without them and be ill." (Respondent 10, male, age 74) "I have a [type of valve] - the decision made because I didn't want to take drugs." (Respondent 37, male, age 43). "I have young children & being incapacitated for any amount of time isn't possible without a lot of support." (Respondent 150, female, age 40)	"Postpone the operation is synonymous with live with a problem and this affects significantly life quality." (Respondent 11, doctor) "Most patients recognise and accept the need for regular monitoring, and therefore put up with the inconvenience." (Respondent 38, doctor)
Retaining an active and participatory lifestyle.	If I'd find myself confined to the house and not able to cycle, walk, garden etc I'd get very low. (Respondent 111, male, age 59) "Being physically active gives me joy and a sense of well-being." (Respondent 57, male, age 59) "I have a busy active life so don't think it would be suitable for me (Respondent 102, female, age 47). Important, because I enjoy the exercise classes I attend and I believe they help to keep me well, and able to join in local activities (respondent	"Anticoagulation has complications, needs a disciplined life and restricts you in your activities and traveling around." (Respondent 18, doctor) "Many patients are inactive which is detrimental to their wellbeing, and we discuss this routinely,

	05, female, age 73) "My idea of physical activity is different, but I still enjoy walking, swimming, yoga and I feel blessed to be able to do those things." (Respondent 159, female, age 53)	advising on regular exercise!" (Respondent 71, doctor)

261

Discussion

The purpose of the study is to work towards a decision support framework for patients with genetically determined aortic root aneurysms. The key decisions are what form of operation to have and when to intervene. The two are interdependent: an operation deferred, allowing progression of the aortic root disease, may reduce the prospects of successful valve conservation. The choice of surgery between valve sparing and valve replacing root replacement is at present more contentious than the dimension at which the patient would be advised to have aortic root surgery and so it is considered first in this discussion.

An active lifestyle was given high importance both by people with Marfan syndrome and their doctors, more so by men than women. (Fig.2&3) This implies avoidance of anticoagulation which is also an obstacle to straightforward pregnancy. This question (No.7) elicited a bimodal response and the free text qualitative analysis makes it clear that those less concerned are older and have completed their families. There is no difference between men and women in this regard. (Fig.2) This is a well-informed patient group; they are often in families with a lived experience of the condition and its consequences, and they have well organised patient associations. The high importance placed on an active life style and on pregnancy leads to a preference for valve sparing surgery. Counselling for patients expressing that preference should include the lifetime probability of valve failure and further intervention.

Patients placed more importance on getting on with an operation than did their doctors (Fig.3) who in the free text qualitative analysis explained their preference for postponing surgery was for the avoidance of surgical risk. In this young group of patients, risk is in fact low. Furthermore there is 'a risk in avoiding risk' if the opportunity is lost to have the more conservative forms of surgery.[10] Unlike their doctor, who sees them for a short consultation every few months, patients may have a constant awareness the risk of a sudden life threatening event. Some patients avoid exertion because of a fear of dissection, further impinging on their quality of life.

There was also a divergence between patients and doctors, and among patients themselves, on the question of tolerating medication while being monitored. (Fig.3) Doctors thought it was of middling importance and patients' responses were bipolar. Of note was the readiness of non-medical individuals to the use the limits of the range, reflecting strongly held individual preferences. On the other hand, doctors tended not to use the limits of the scales, taking a middling view for range of clinical circumstances. But the patient's rating is the one we want to capture. A patient taking beta blockers may accept lack of physical or sexual performance in exchange for a better chance of survival, but have they had adequate opportunity to have the true effect on survival quantified for them?[11;12] Might not an expressed intolerance of beta blockers be a sound reason to choose earlier surgery?

Decision aids have been demonstrated to be effective in supporting patients and doctors making shared treatment decisions, particularly in circumstances where there are various treatment options available, but with outcomes which may result in different benefits and

harms.[13] A recent update of a systematic review in decision aids concluded that decision aids resulted in better knowledge of options and outcomes by patients, and that they were more satisfied with the decision. There is moderate evidence that patients took a more active role in decision making and authors concluded that there is emerging evidence of directly value-based choices through decision aids and positive effects on communication between patient and health practioner.[14-17]

Well know limitations of 'surveys' are small size and biased sample. The Marfan Foundation in America is advised by its Professional Advisory Board who have declined to work with us previously. The Foundation did not answer our request to have the study shared with their members. This is a concern for us and it should be remembered if a 'small sample size' limitation of the study is considered. The UK Marfan Association have been helpful throughout. It should also be remembered that for this sort of exercise, there may be no calculable size to 'power' the study; there is instead a judgement to be made about whether 'saturation' has been reached. It is unlikely that substantially important new themes would have emerged with a larger sample size. With respect to bias, we believe that the 142 patients were reasonable representative from the age range and distributions but in any case, we are interested in developing a process for individuals and drawing no particular inferences about the numbers of people giving any particular view. More important is that the range and variety of views were probably captured.

Conclusions

The use of a decision support framework should not be regarded as replacing face to face counselling. Instead it allows patients to weight up their choices and come to the consultation more prepared for a discussion of the decisions which face them. The next step in this project is to encourage teams counselling people making these decisions to test this process. We seek collaborators willing to do so and are actively disseminating these findings to patient groups.

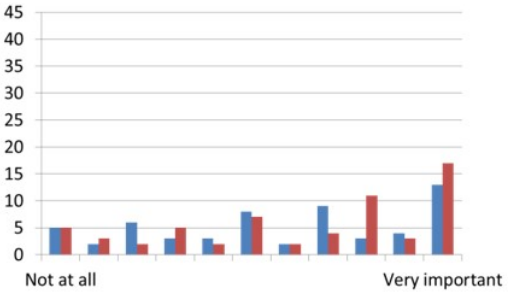
Legends to figures

Figure 1.Location of respondents.

Figure 2. Males (N=58 blue) versus females (N=61 red) of 119 people with Marfan syndrome (including two doctors)

Figure 3. People affected by Marfan syndrome (N=117, blue) compared with doctors (N=25 red) including the 2 who also had Marfan syndrome).

1. How important is it to you to postpone having an operation on your aorta for as long as the doctors think it is safe to do so?



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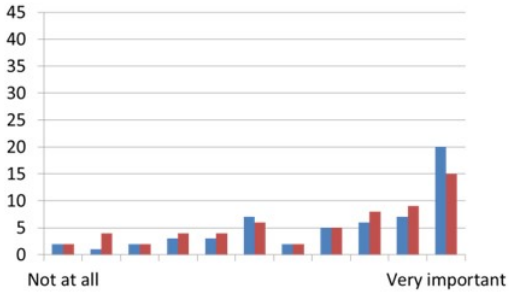

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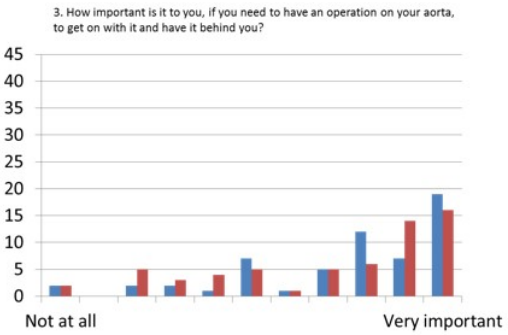

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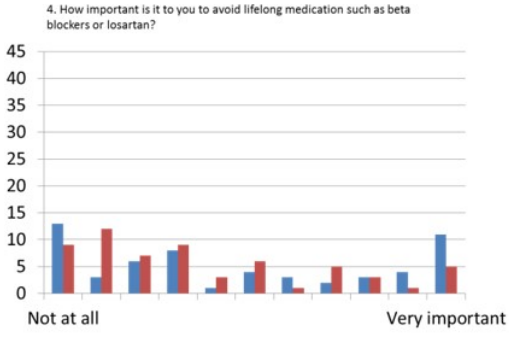

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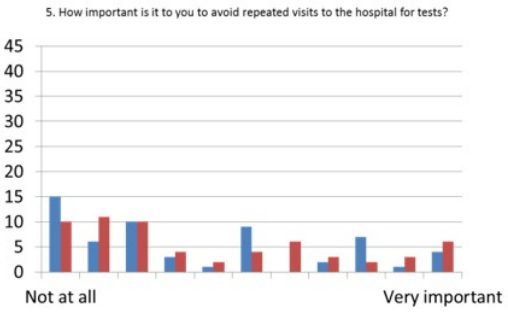

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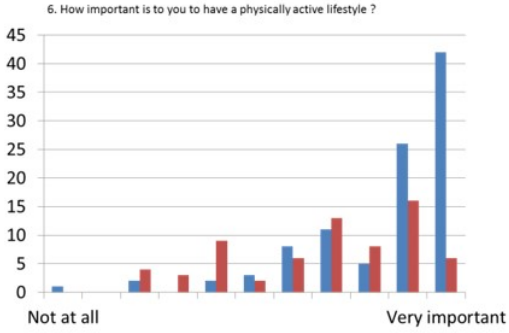

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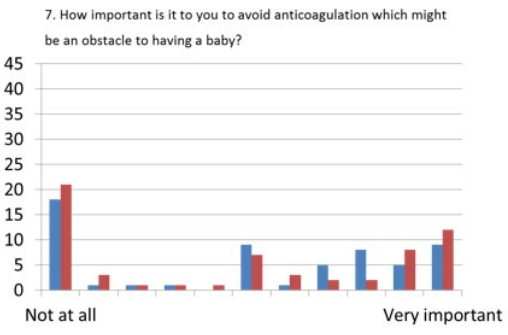

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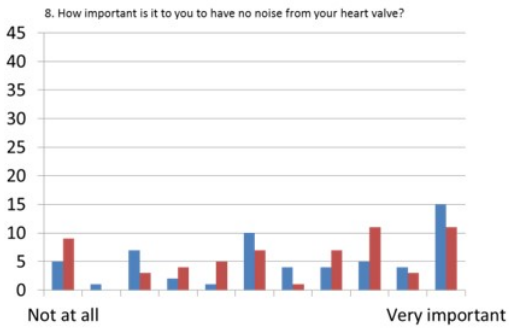

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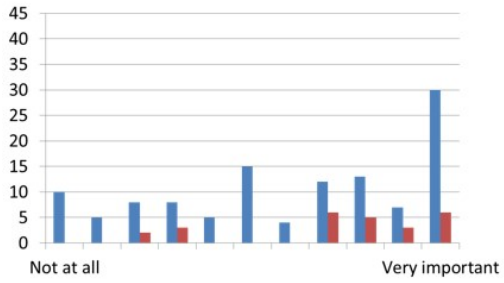

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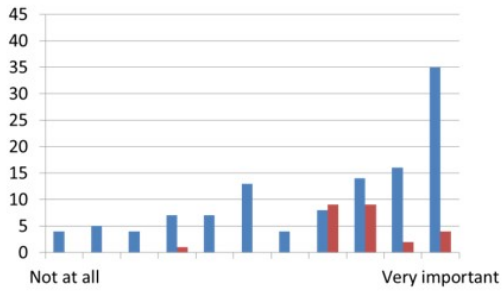

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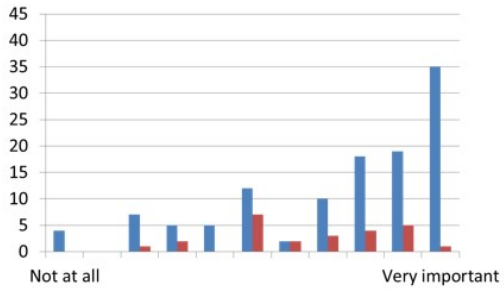

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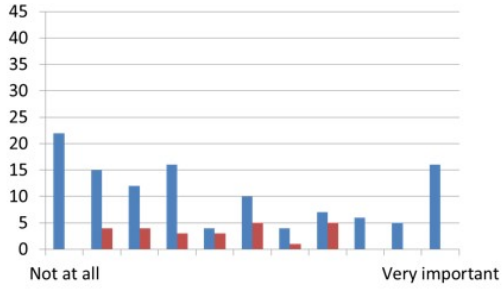

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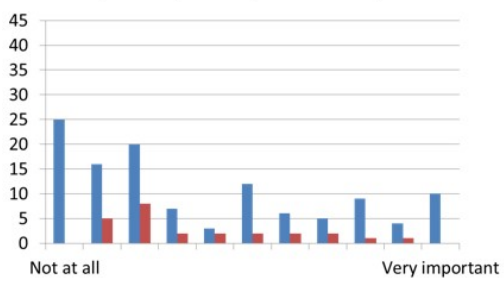

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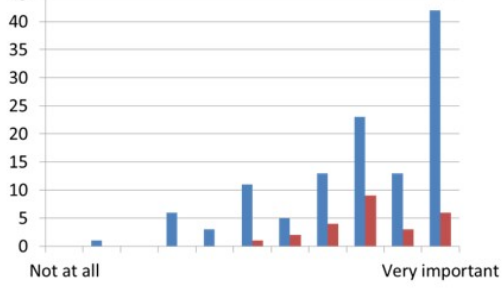

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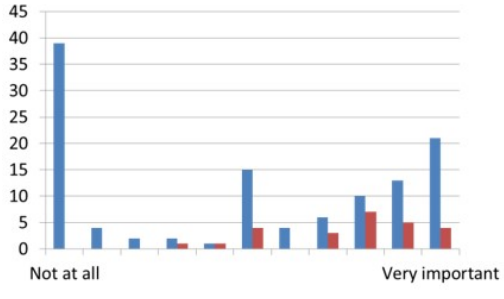

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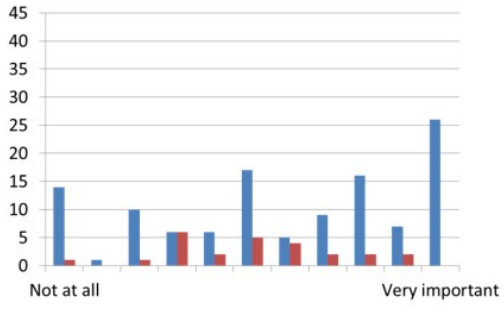

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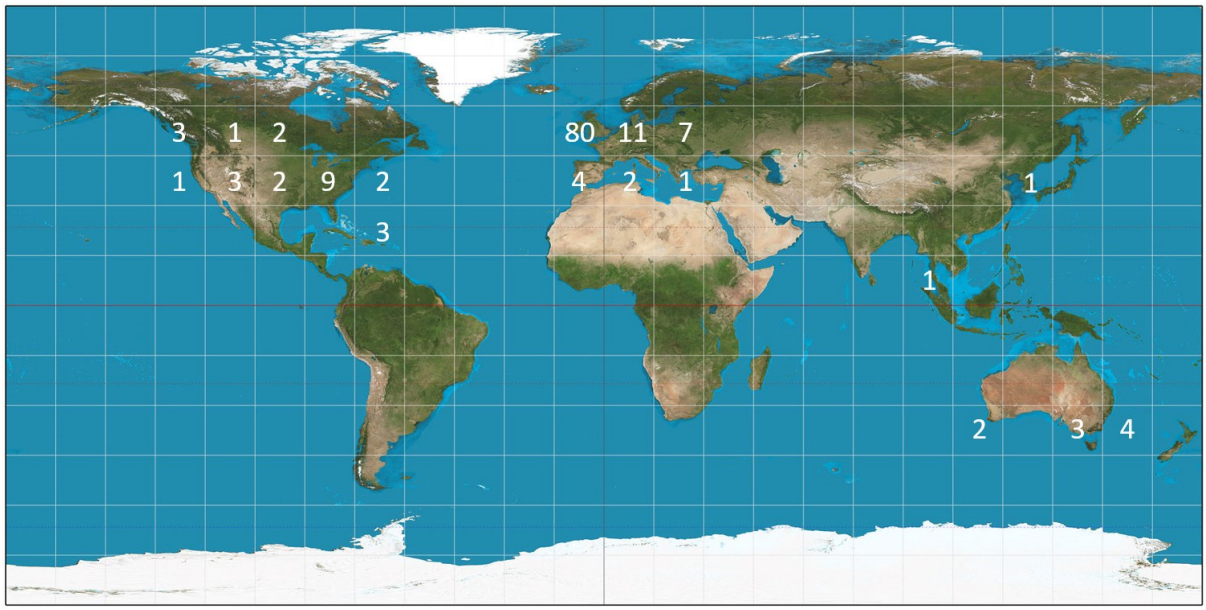
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Glossary

PEARS Personalised External Aortic Root Support

ODSF Ottawa Decision Support Framework

IRAS Integrated Research Application System

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Graeme Hankey (Australia) neurologist and health service researcher who has had aortic root surgery and written about his experience.[18]

Robert Shreiber (USA) patients and data analyst.

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