What types of research can be done in Nuclear Medicine?

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This presentation does not set out to consider what types of research can be done in nuclear medicine, as that would rather ambitious. Instead it seeks to explore the sorts of research that technologists and radiographers might easily and meaningfully engage with in nuclear medicine. First the presentation commences with an explanation of what research might consist of and what kind of intellectual contribution to research would be required to consider oneself as a researcher therefore co-author on published work. The presentation will then progress to areas in which research could occur and what kinds of approaches could be taken to answer nuclear medicine related research questions.

Research can be defined as a systematic enquiry that follows a methodology specific to the problem or question being investigated. The methodology may in some cases have to be sympathetic to the context and, as such, at first sight appear as insufficiently robust. Depending upon the approach taken two quite different methodologies can be adopted – qualitative and quantitative. The former involves the collection and analyses of numbers; the latter could involve collection and analysis of written and/or spoken comments and/or observations. Both research paradigms have their place in nuclear medicine. Typically a researcher would commence by understanding the relevant literature that has been published in the field, this would be followed creation and then adherence to a data collection method; conclusions would then be drawn about the generated data and/or speculations (inferences) made beyond that data. An alternative approach would involve having no prior knowledge of the subject specific literature as it is said that possession of this could bias data collection and analysis. This approach is associated with certain types of qualitative methodologies. Whichever approach is taken, high in the researcher's mind when designing an approach to answering a research question or understanding a problem, would be the selection of an appropriate methodology. In some instances the research question could demand a quite complex approach and involve a 'mixed methodology', which could comprise of different ways of looking at the same problem. This could include using both qualitative and quantitative approaches. The process of creating a robust method is often iterative and incremental and testing of it (pilot) can occur on several occasions before the researcher is happy for it to be used.

It is not usual, these days, to perform research in isolation of others, as such research tends to be team-based. With this in mind it is important to understand what constitutes a legitimate intellectual contribution to a piece of research as it is only when this occurs that you could be considered as a true researcher and therefore co-author on published work. Consequently to be a co-author / researcher you would be able to demonstrate a substantial intellectual contribution [1]. Such a contribution could come in many forms, including input to conception and design, acquisition and interpretation of data, drafting an article / conference paper or making a significant revision to an original draft. Of course all co-authors / researchers should approve the final version ready for publication or presentation. Considerable debate has surrounded co-authorship and criticism has been levied at published papers that contain many co-authors (a fairly recent publication, for instance, contained over 100 co-authors). Similarly, in relation to data collection (specifically the scanning of nuclear medicine patients), much debate has been had about whether the nuclear medicine radiographer or technologist should be considered as co-author / researcher. Personally I would argue 'no' in that instance, because no significant intellectual contribution would have been made. In this case an acknowledgement on the paper would be highly appropriate. Of course if in addition to the scanning of patients a significant intellectual contribution had been made (as defined above) then co-authorship would be mandatory. I place emphasis on the word 'mandatory' – from an ethical and legal standpoint. Passing somebody else's intellectual work of as your own is highly improper and a legal case can be made to this effect. In my experience I have found that agreeing who will be co-researcher and co-author at the onset helps to set expectations and also minimises the chance of disappointment and conflict after a paper has been published. Let us now consider what research areas a nuclear medicine technologist / radiographer might meaningfully make a significant intellectual contribution to and thereby become first or co-author on a published journal or conference paper.

Intellectually there are no restrictions on the types of research that could be engaged with, albeit you would be wise to have adequate research training prior to starting. Recognised research training programmes exist to develop knowledge and skill and each can have particular biases. Traditionally, PhD and MPhils have been common place, but these have driven the trainee researcher down quite narrow paths (methodologically speaking). Professional Doctorates and Masters in Research are broader in their methodological coverage and they are said to develop an individual's research ability better than the tradition approaches. That said, due to

their very nature the research outcome (eg novelty) tend to be of a lesser order, as the research per se has less emphasis placed upon it. For instance, for a professional doctorate only the final 3 years of the 5 year programme (part time) is devoted to 'the research project'. For a traditional PhD (part time) the whole 5 years is devoted to 'the research project'. Clearly each way of training researchers has its values and limitations. Masters of Science ('taught') and Bachelors of Science degrees develop some research ability, but due to their limited emphasis on the research processes they are really quite introductory compared with the bespoke research training programmes (eg PhD, Professional Doctorate).

Legally and ethically there could be restrictions on the types of research that you could engage with in isolation of other professionals. For instance research involving human VOLUNTEERS and radiation exposure would likely require a suitably qualified and experienced medical practitioner in the team. Support would also be required from a radiation protection advisor (who would likely be medical physicist). Having these professionals on the research team would comply with certain legal requirements. However this does not mean the research could be conducted, simply because the ethical principles involved in the proposed activity maybe ill-founded. As such an ethical committee could reject the research proposal long before it gets underway.

Nuclear medicine research is often conducted on animals (referred to as pre clinical work), but I have no intention to review this as this is a specialist area of which I have no knowledge. However another area in which research can be conducted without patient / human involvement is in laboratory-based and phantom-based research. Such areas are ideal for research as the ethical and legal requirements can be considerably reduced when compared to those involving humans and ionising radiation.

The areas in which a meaningful contribution could be made might include single and multi-centre clinical trails (typically being randomised controlled trials) – though this would require a skilled and experienced multi-professional research team to design and conduct it. In such instances it is likely your contribution would be small, so small in some cases that it would be hard to prove you had made a significant contribution. But don't be perturbed – if this sort of work interests you then develop the skills and seek to join a team. Less ambitious and more realistic options could prove more fruitful, especially in your early stages of getting involved with research. With this in mind consider reflecting upon your practical / clinical experience and examine the literature. Ask yourself – "where do knowledge gaps exist and what is achievable within my scope of practice and those who would be willing to do research alongside me".

Following this suggestion through, if you examine nuclear medicine journals you will note a major gap in research knowledge. Nuclear medicine journals tend to have a major emphasis on 'the medical model' and more often than not a positivist / experimental research paradigm is used. Such approaches are not particularly good for examining how people feel, behave and what their perceptions might be. Not surprisingly this type of information is quite devoid in nuclear medicine journals. This area lends itself nicely to qualitative research and this area would fit quite neatly with radiographer and technologist roles. Such research is rich in data and it can give us a meaningful understanding of how patient care could be changed and improved. Data collection methods that can be used include observation, participant observation, interviews and focus group discussions. Analysis of the generated qualitative data is highly complex, but thematic analysis is commonly used to determine commonalties and re-occurrences within and between people. Philosophically, some would argue that such 'grouping' together of similarities gets away from the richness of the qualitative data and analysing discrete individual perspectives can be common in this type of research. Of course generalisations cannot be made from the latter; then again inferences beyond the data would be inappropriate in certain types of qualitative research as that would not be the purpose of the investigation.

A common methodological approach that has been used in many journal papers is the use of an intervention, with baseline and post intervention measurements being taken. In addition to an experimental group (ie the one that will experience the intervention) some studies also contain a control group and maybe a placebo group too. There may be randomisation of subjects into the groups and often the researcher would try to match, as closely as possible, various volunteer characteristics. Sources of error would be identified (and ideally minimised) in advance of performing the research. The intention in these sorts of studies would be to use descriptive and/or inferential statistics to establish whether relationships exist between parameters. Methodological designs such as these can be used for a whole range of applications. These include: assessing different ways of informing patients about their procedure; assessing the diagnostic values and performance (patient and/or phantom-based) of different imaging modalities and methodologies; and assessing if one method of learning / teaching is more effective than another. The first and the last of these can fall well within the scope of what a nuclear medicine technologist / radiographer could reasonably demonstrate a significant research contribution to. The middle one could too, but again a broader multi-professional team would be required.

Within my presentation I shall illustrate the use of different methodological approaches that can be used to answer specific research questions. These will be simplified to ensure the points made in this text are clearly highlighted.

References

International Committee of Medical Journal Editors, http://www.icmje.org/.