

ISSN 2312-5705

Volume 2 Issue 1, May 2015

MJHS

MALTA JOURNAL OF HEALTH SCIENCES



UNIVERSITY OF MALTA
L-Università ta' Malta

FACULTY OF HEALTH SCIENCES

www.um.edu.mt/healthsciences/mjhs

Editorial Board

Chairperson

Professor Angela Xuereb
Dean, Faculty of Health Sciences,
University of Malta,
MSD 2080, Malta.
angela.a.xuereb@um.edu.mt

Editor-in-Chief

Dr Daniela Gatt
Department of Communication Therapy,
University of Malta,
MSD 2080, Malta.
mjhs@um.edu.mt

Associate Editors

Dr Stephen Lungaro-Mifsud
Department of Physiotherapy
stephen.lungaro-mifsud@um.edu.mt

Dr Josianne Scerri
Department of Nursing
josianne.scerri@um.edu.mt

Dr Victoria Sultana
Department of Nursing
victoria.sultana@um.edu.mt

Dr Vasilis Valdramidis
Department of Food Studies & Env. Health
vasilis.valdramidis@um.edu.mt

Dr Francis Zarb
Department of Radiography
francis.zarb@um.edu.mt

Advisors

Dr Rita Borg Xuereb, Department of Midwifery
Dr Sandra Buttigieg, Department of Health Services Management
Dr Cynthia Formosa, Department of Podiatry
Prof. Carmel J. Caruana, Department of Medical Physics
Mr René Mifsud, Department of Occupational Therapy

Copy Editors

Web Administrators

Dr John Paul Cauchi
Dr Stephen Lungaro-Mifsud
Dr Vasilis Valdramidis
Dr Francis Zarb

Ms Juanita Briffa
juanita.briffa@um.edu.mt
Mr Nicolai Schembri
nicolai.schembri@um.edu.mt

Aim and scope

The *Malta Journal of Health Sciences* is a peer-reviewed, open access publication that promotes the sharing and exchange of knowledge in Health Sciences. It provides a platform for novice and established researchers to share their findings, insights and views within an inter-professional context. The Journal originates within the Faculty of Health Sciences, University of Malta.

The *Malta Journal of Health Sciences* disseminates research on a broad range of allied health disciplines. It publishes original research papers, review articles, short communications, commentaries, letters to the editor and book reviews. The readership of the journal consists of academics, practitioners and trainee health professionals across the disciplines of Applied Biomedical Science, Audiology, Communication Therapy, Community Nursing, Environmental Health, Food Science, Health Services Management, Medical Physics, Mental Health Nursing, Midwifery, Nursing, Occupational Therapy, Physiotherapy, Podiatry and Radiography.

Submitted manuscripts undergo independent blind peer review, typically by two reviewers with relevant expertise. All manuscripts are reviewed as rapidly as possible and an editorial decision is generally reached within approximately two months of submission. Authors of manuscripts that require revisions will have two weeks to submit their revised manuscripts. No manuscript that has already been published or is under consideration for publication elsewhere will be considered.

Types of manuscripts

Review articles will present a substantial survey with an adequate historical perspective of the literature in an area of Health Sciences. The manuscript should not exceed the limit of 5,000 words.

Research papers should be manuscripts comprising complete reports of original, scientifically sound research. They must contribute new knowledge, be prepared for a wide readership and should not exceed 4,000 words.

Short communications should be brief reports of scientifically sound research, but of limited scope e.g. limited amount of data, that contribute new knowledge. They should not exceed 2,000 words.

Commentaries should be focused and opinionated articles on any subject within the scope of the Journal. These articles should be related to a contemporary issue, such as recent research findings. They should not exceed 2,000 words.

Letters to the editor should provide further debate on a topic addressed by a paper published in the Journal. Authors of the manuscript will be sent an edited copy of the letter and they will have the right to reply. They should not exceed 1,000 words.

Book reviews should be timely and objective. They should discuss and assess the main ideas and major objectives of the book and how effectively these are accomplished. Finally, constructive comments about the strengths and weaknesses of the book should be presented. They should not exceed 1,000 words.

The manuscript lengths cited above do not include the Abstract and References.

Instructions for authors

Prior to manuscript submission, it should be ensured that the following guidelines are adhered to. Manuscripts not conforming to these guidelines may be returned.

Submission of Manuscripts

Manuscripts are to be emailed to the Editor-in-Chief on mjhs@um.edu.mt

General guidelines

All papers must be written in correct and consistent English (UK). The manuscript, including references, tables and figure legends, should be typed in double line spacing, with margins at least 25 mm on each side. Text should be standard 10 or 12 pt.

Author names and/or affiliations should not appear anywhere in the manuscript pages or images in order to ensure blind peer review. Continuous line numbers should be added to the whole document (in Microsoft Word: View menu → Print Layout → Layout → Text Layout → Line Numbers).

Title page: The full title page should also be submitted as a separate document and should include the following:

Title of paper Abbreviations should not be used in the title.

Submission category This should be specified as full research paper, book review etc.

Authors Full names of all authors are to be provided, followed by qualifications, affiliations and addresses. The corresponding author should be indicated and full details, including email and mailing addresses and telephone numbers, should be provided.

Running Head A running headline of not more than 40 characters should be included at the top of the page.

Blind title page: A blind title page giving only the title without author details should also be submitted.

Abstract: The abstract should be an accurate summary of the paper presented in one paragraph (not exceeding 300 words). The abstract should:

- (i) indicate the specific purpose of the article;
- (ii) describe the methodology used to achieve the purpose;
- (iii) present the findings including key statistics (this section may be omitted for articles that are not data-based);
- (iv) present the conclusions based on the data provided;
- (v) highlight the novelty of the work.

The abstract should preferably not include references.

Keywords: Immediately after the abstract, a list of up to 6 key words is to be included. Selected words and phrases should relate directly to the content of your work.

N.B. The title, abstract and keywords should be chosen carefully as they determine the ease with which readers access the article through online search engines.

Main text: The article text should consist of the sections outlined below, in the same order. Results or Findings and Discussion could also be combined. Repetitions between sections should be avoided. Abbreviations and acronyms may be used where appropriate but must always be defined at their first mention.

Introduction Briefly describe the purpose of your work, explain its importance and provide a relevant theoretical background.

Methods Describe the research design, the materials and/or participants and the methods used for data collection. Sufficient detail should be provided to allow reproduction of the study design.

Results or Findings Present results in a clear and logical sequence. If tables are used, do not duplicate the data in the text but describe trends and main points.

Discussion This should provide an interpretation of the results without repeating them.

Conclusions The main conclusions of the paper are to be presented in this section.

Acknowledgements (if relevant) Collate acknowledgements in a separate section at the end of the article before the references. N.B. Please refer to the section on Ethical Guidelines for more information.

References Authors are responsible for the accuracy of references. All references must appear both in the text and the reference list. References should follow the Harvard referencing system. In the text, the information required is:

- the surname of the authors;
- the year of publication;

the page number (direct quotes only).

Commas are used to separate information within parentheses e.g. (author's name, year of publication). Full stops are always used after the abbreviation *p.* for page number e.g. p.34 (or pp. for multiple pages). If the citation is at the end of the sentence, it is considered to be part of the sentence, so the full stop is placed after the closing parenthesis.

Examples

Book (1 author)

Neville, C. (2010) *The Complete Guide to Referencing and Avoiding Plagiarism*. 2nd Ed. Maidenhead: Open University Press.

In text:

Neville (2010) argues that...

Book (2 to 3 authors)

Bradbury, I., Boyle, J. & Morse, A. (2002) *Scientific Principles for Physical Geographers*. Harlow: Prentice Hall.

In text:

Bradbury, Boyle and Morse (2002)...

Book (4 or more authors)

Reece, J.B., Urry, L.A., Cain, N.L., Wasserman, S.A., Minorsky, P.V. & Jackson, R.B. (2012) *Campbell Biology*. 9th Ed. London: Benjamin Cummings.

In text:

(Reece et al., 2012)...

Journal article (printed)

Trefts, K. & Blacksee, S. (2000) Did you hear the one about Boolean Operators? Incorporating comedy into the library induction. *Reference Services Review*, 28(4), pp.369-378.

In text:

Trefts and Blacksee (2000) argue that....

Journal article (electronic/online)

Wilson, J. (1995) Enter the Cyberpunk librarian: future directions in cyberspace. *Library Review*. [Online] Emerald Database 44(8), pp.63-72. Available from: <http://www.emeraldinsight.com>. [Accessed: 30th January 2012].

In text

Wilson (1995) argues that.....

Website

BBC News.(2008)*Factory gloom worst since 1980*. [Online] Available from:<http://news.bbc.co.uk/1/hi/business/7681569.stm>. [Accessed: 19th June 2012].

References should be arranged first alphabetically and then further sorted chronologically if necessary. More than one reference from the same author(s) in the same year must be identified by the letters "a", "b", "c" etc., placed after the year of publication.

Tables should be referred to specifically in the text of the article and provided in the same document. They should be in editable MS Word format.

Number tables consecutively with Arabic numerals (1, 2, 3 etc.), in the order in which they appear in the text. Each table should have a short descriptive title, be self-explanatory and not duplicate data given in the text or figures. Ensure that all columns and rows are properly aligned. Include horizontal rules at the top and bottom of a table and one below the column headings. If a column heading encompasses two or more subheadings, then the main headings and subheadings should be separated by a single short rule. No other rules should be included, neither horizontal nor vertical. Appropriate space should be used to separate columns. Rows should be double-spaced.

A table may have footnotes if necessary. Each footnote should begin on a new line. Abbreviations in tables should be defined in footnotes even if defined in the text or in a previous table.

Figures should be referred to specifically in the text of the paper. Number figures consecutively using Arabic numerals and avoid repeating material in the text. Abbreviations used in figures should be defined in the caption.

Image files should be supplied in EPS, TIFF, PDF, PPT or JPEG format, with each figure uploaded separately and numbered. Unless essential to the content of the article, all illustrations should be supplied in black and white with no colour contained within them. Files should be saved at the appropriate dpi (dots per inch) for the type of graphic - definitely not less than the typical screen value of 72 dpi for both the vertical and horizontal directions. Lower resolutions will not be usable.

Save line drawings at 800 dpi or 1200 dpi for fine line work and 300 dpi for halftone and colour work. The image should be cropped to show just the relevant area, while the amount of white space around the illustration should be kept to a minimum. Supply illustrations at the size they are to be printed, usually 76 mm wide (single column of text) or, for especially large figures, 161 mm wide (two columns of text). All annotations should be included within the images supplied.

Participant identity must be obscured.

Additional points to note:

(i) do not put a box around graphs, diagrams or other artwork;
(ii) avoid background gridlines unless these are essential (e.g. confidence limits);

(iii) ensure that lettering is appropriately sized and corresponds to 8 or 9 pt when printed;

(iv) include all units of measurement on axes;

(v) all lines (e.g. graph axes) should have a minimum width of 1/4 pt (0.1 mm), otherwise they will not print; 1 pt weight is preferable;

(vi) avoid using tints (solid black and white or variations of crosshatching are preferred). Any tints that are used must be at a minimum 5% level to print (but do not use too high a tint as it may print too dark);

(vii) do not use three-dimensional histograms when the addition of a third dimension gives no further information.

Appendices are discouraged if the material can be included in the main text. If an appendix is necessary e.g. mathematical calculations that would disrupt the text, it should be supplied as a separate file. If more than one appendix are included, these should be identified using different letters. An appendix may contain references. Appendices must be referred to in the main text.

Footnotes should be used sparingly. If used, they should be numbered consecutively throughout the paper using superscript Arabic numbers. Do not include footnotes in the reference list.

Peer review process

All manuscripts are pre-screened by the Editor-in-Chief (or Editorial Board member) upon submission. Priority is given to articles that will help allied health professionals to make better decisions, increase pertinent knowledge base and support high quality research. Immediate manuscript rejection by the *Malta Journal of Health Sciences* is expected in the following instances:

(i) study does not have a theoretical or evidence-based argument for the relevance of the work to allied health practice;

(ii) manuscript does not contain sufficiently new or important information and therefore does not offer a significant contribution to the literature;

(iii) reliability study does not include a discussion of the influence that the findings will have in the field;

(iv) study evaluates a new test without a sound comparison to current tests;

(v) study has serious flaws in the Methods section;

(vi) authors did not obtain ethics approval from a properly constituted ethics committee, where appropriate.

Manuscripts that qualify for review are evaluated by at least two experts as appropriate. A double blind review process is adopted.

After the reviewers receive a paper from the editor, they read it closely and provide individual critiques in which they:

- (i) comment on the validity of the science, identifying scientific errors and evaluating the design and methodology used;
- (ii) judge its significance by evaluating the importance of the findings;
- (iii) determine the originality of the work based on how much it advances the field;
- (iv) recommend that the manuscript is rejected or accepted with minor revision; major revision will entail resubmission and further review.

The Editor-in-Chief/Editorial Board member reads the manuscript and the reviewers' comments, makes his/her own comments, and provides guidance to the Editorial Board on the suitability of the manuscript for publication. The Editor-in-Chief does not need to heed this recommendation. The Editorial Board will then decide on the content of the feedback letter to the author/s.

Ethical guidelines

The *Malta Journal of Health Sciences* adheres to the following ethical guidelines for research and publication.

Authorship

The definition of authorship is based on the following criteria:

- (i) significant contribution of authors to the conception and design of the research, data collection or analysis and interpretation of data;
- (ii) drafting and/or critically reviewing the manuscript for its academic content;
- (iii) providing final approval of the version to be submitted (or resubmitted) for publishing.

Authors are expected to meet all three criteria. Contributors who do not qualify under the authorship criteria should be included in the Acknowledgments section.

Acknowledgments

Any acknowledgements should be included at the end of the article, prior to the Declaration of Conflicting Interests (if applicable) and your References. Any sources of funding must also be acknowledged under a separate heading entitled *Funding*, directly after the Acknowledgments section. Funding acknowledgments should be in the form of a sentence as shown below, with the funding agency written in full, followed by the grant number in square brackets:

This work was supported by XXX [grant number xxx].

Declaration of conflicting interests

Authors are expected to disclose any associations that might pose a conflict of interest in connection with the submitted manuscript. All sources of funding or products must be included in the Acknowledgments section of the manuscript.

Originality of work

Submission of a manuscript implies that the work described:

- (i) has not been published before (except in the form of an abstract or academic thesis), and
- (ii) is not under consideration for publication elsewhere. If the manuscript is accepted for publication, it cannot be published in the same form elsewhere, in print or electronically, in English or in any other language, without the written consent of the copyright-holder.

Permissions

When previously published material (e.g. tables, photographs or illustrations) are included in submitted manuscripts, the authors are required to obtain a written statement from the copyright holder giving permission for reproduction. A copy of the permission obtained must be submitted to the Editor-in-Chief of this journal.

Author misconduct and article withdrawal

As a policy, submitted articles are checked for plagiarism using duplication detecting software. The Editor-in-Chief reserves the right to reject any manuscript where it is suspected there is unethical conduct during a research project, or in the manuscript authoring or content.

Studies involving human and animal subjects (details)

Research undertaken with human and animal subjects must have been carried out in accordance with relevant internationally accepted guidelines such as the Declaration of Helsinki for clinical research involving humans (<http://www.wma.net/en/30publications/10policies/b3/index.html>), recommendations by the International committee of Medical Journal Editors (<http://www.icmje.org>), the British Educational Research Association ethical guidelines (<http://www.bera.ac.uk/publications/Ethical%20Guidelines>) and the EU Directive 2010/63/EU for research on animals (http://ec.europa.eu/environment/chemicals/lab_animals/legislation_en.htm).

Ethical approval

Ethical approval from a research ethics committee and/or institutional review board is usually required and details regarding the board providing approval should be listed in the Methods section of the manuscript.

Publishing policy

Copyright on the published article will be retained by the author/s. Authors grant the *Malta Journal of Health Sciences* license to publish the article and identify itself as the original publisher. In addition, authors may allow any third party the right to use the article as long as its original authors, citation details and publisher are identified, save for commercial purposes. Individual users may access, download, copy, display and redistribute to colleagues open access *Malta Journal of Health Sciences* articles solely for non-commercial and non-promotional purposes.

Table of Contents

Malta Journal of Health Sciences Volume 2 - Issue 1 (May 2015)

Guest Editorial	
1	The growth of a new Mental Health Department Martin Ward
<hr/>	
Regular Articles	
2	The nurse is present: a review exploring the temporality of illness through presence and narrative, an artist's perspective Review Article Pamela Baldacchino
9	Investigating the effect of long-term musical experience on the auditory processing skills of young Maltese adults Research Article Martha Pace and Nadine Calleja
16	The use of joint attention in the naturalistic setting in children with Autism Spectrum Disorders Research Article Cheryl Dalli and Joseph Agius
<hr/>	
Commentary	
22	The current situation for the water sources in the Maltese Islands David Spiteri, Chris Scerri and Vasilis Valdramidis
<hr/>	
Short Communication	
26	Community awareness and perception towards rodent control: implications for prevention and control of Lassa fever in urban slums of Southwestern Nigeria Adebimpe Wasiu Olalekan

The Growth of a New Mental Health Department

Martin Ward

Head, Department of Mental Health, Faculty of Health Sciences, University of Malta, Msida, Malta

January 2004 was a difficult time for mental health nursing within the then Institute of Health Care. Already one semester late in starting the new B.Sc. conversion course for general nurses working in mental health care, it had no curriculum, no lecturers, no release mechanism from the practice areas, no clinical supervision and no recognised method of evaluating practice competencies. In short, it did not exist and 33 students were frustrated, waiting for it to start. In addition, both the second year general Nursing diploma and degree student groups were expecting to receive theoretical and practice study units to meet their registration requirements. Martin Ward and Josanne Drago Bason were appointed in different capacities to develop, manage and deliver all of the above, and had just 21 days to begin.

An incomplete hard copy of the original diploma to degree programme was located and with a considerable amount of reconfiguration, negotiation and bargaining, this allowed the “team” to start the first semester. Within weeks, the 33 students had reduced to 18 as they realised the complexity of the course they had enrolled for. By the end of that first semester, this number had further reduced to 11, with 10 of these completing the course. However, the troubles were not over because the University wanted the programme to finish at the same time as every other course, meaning this first course had to be reduced by a whole semester, running for two and a half years instead of three. As the remaining students already held a Diploma in Mental Health Nursing, this was feasible but required a considerable amount of academic dexterity to make it happen. Lessons from the first semester were learnt and with the considerable help of the mental health service managers, the whole programme of studies was re-designed. Robust clinical support measures were introduced to enable students to complete practice-based competencies, including a proper release mechanism to allow them to attend the theoretical elements, which were also practically re-written. Even the number of students and cohorts had to be reconsidered as it became obvious that the mental health services could not support the drain on its human resources that large numbers of students on the programme would cause. The summer of 2004 was a busy time as a new cohort of students was recruited for the next academic year, meaning that the “team” was now working double time.

That first cohort of students completed the course in the required time, by summer 2006. But, at their graduation ceremony it was discovered that they had been awarded nursing degrees, not mental health ones. This was eventually rectified, much to everyone’s relief!

Scroll forward another nine years. The “team”, now consisting of four, is responsible for two undergraduate programmes - the original part-time programme and a newer full-time one, a part-time Master programme in Mental Health Nursing and a full-time dual international Master programme, in collaboration with the University of Southern Indiana USA, in Community Psychiatric Nursing - a programme of studies unique to mental health nursing. The signing of that contract between the two universities in

December 2014, after two and a half years of negotiations, paved the way for one last milestone. After progressing through Faculty Board, University Senate and Council meetings, in February 2015 mental health nursing finally left the nursing department to become a department in its own right - *the Department of Mental Health*. As the name suggests, no longer focusing only on nursing (though for the time being, certainly its main activity), it will concentrate on both short undergraduate courses and postgraduate ones in areas of mental health specialisation, e.g., childhood and adolescence, substance misuse, rehabilitation, early intervention in psychosis, for all staff working in mental health care. As a multi-disciplinary department, it is intended that it will fill a gap in both the University’s provision and the Maltese needs for intensive mental health care support. In effect, it is hoped that it will impact upon the fabric of society and become a key stakeholder in future mental health care developments.

Of course, the development, support and delivery of these courses took a great deal of time and expertise, not least from the “team”, past and present, whose commitment and dedication made it all possible. Many other people have contributed to the growth of this department from its humble beginnings and, undoubtedly, there will be many more in the future. To you, mental health offers a huge thank you. This progression is even more remarkable when considered against the stigma that mental health is faced with generally and from every quarter of society. The exciting thing is that the future holds so many further possibilities. So, while the old saying goes “From little acorns, big oak trees grow”, in the case of mental health within the Faculty of Health Sciences, it should read “Little steps make great journeys.”

THE NURSE IS PRESENT: A REVIEW EXPLORING THE TEMPORALITY OF ILLNESS THROUGH PRESENCE AND NARRATIVE, AN ARTIST'S PERSPECTIVE

Pamela Baldacchino

Department of Digital Arts, Faculty of Media and Knowledge Sciences, University of Malta, Msida, Malta

Abstract. "Illness works to deform and distort all the meaning and value one gives to one's life" (Ahlzén, 2011, p.325). A feeling of terminal loss is experienced within the physical body as chaos floods the brain. Even language is incapable of fully addressing the internal tension that comes with illness, because it strives to make articulate the unrepresentable or the abject. This review is directed towards analysing the experience of embodiment in illness, one's relation to the self and to others, all within a particular context such as a place of constraint (hospital) or exchange (museum). The mediation between care and art practice, in fact, allows for the emergence of similar states that fluctuate between closeness and distance and between the unrepresentable and the representable as they enter in a process of dialogue. Such states allow the nurse and the artist to engage freely with the Other in a space defined by the intensity of the present moment and its assimilation through the path of narrativity. An empathic audio-visual tool called Sanctuary was created to serve a narrative, the ill person's narrative. It is presented in the form of a visor which allows the viewer to enter a 'bunker-like' space. An empathic encounter with the self, aims to be triggered through the process of participation in the artwork. The play of tension within a restorative, sheltering space is followed with planned empathic dialogue between the nurse and the ill person.

Keywords: transdisciplinarity, embodiment, presence, narrative, empathy, abjection

1 *Memories Unfolding: the silent narrative*

The two young nurses, carrying their fragility along with a basin of water, towels and sheets, dressing packs and saline solutions, enter the tiny cubicle on the left. They struggle to keep breathing, tasting the putrefaction. Pulling the curtain back, they greet the old lady in bed. She turns towards them with her dull eyes. They

Correspondence to: Pamela Baldacchino
(pamelabaldacchino@gmail.com)

Received: 31.01.14 - Revised: 04.04.14 - Accepted: 05.04.14 -
Published: 25.05.15

© 2015 The author

unloosen the bed clothes and wipe her face with a damp cloth; going over the plain of her forehead, across the ridge of her nose, along the mound of her cheek bones and over the crevice of her mouth, avoiding the cavernous eyes. The nurse on the old lady's right side starts to lather the wash cloth and proceeds to soap the hands, taking care to get in-between the fingers, then up the arms, around the neck and along the jaw line and shoulders. She moves aside the crumpled sheet and washes the old lady's breasts down to her waist.

The soap floats aimlessly in the basin, leaving trails of cloudy water. Whilst one nurse washes and rinses, the other pats dry the loosening skin surprisingly soft to touch. A silence hangs in the air as they work in unison. Slowly, the old lady's left leg is lifted up and the bandage unravelled with an imperceptible tremor. The air thickens and becomes solid. A face twitches and a throat softly cleared. The blackened leg is held suspended above the bed while being rinsed with saline, dried with thick swabs and a new dressing placed using disposable forceps. With the final bandage reapplied, the nurses proceed to turn the old lady over so as to finish her bath.

A prolonged, soothing sound escapes into the air like steam. Sheets are changed, dirty linen gathered, personal items sorted and the nurses are ready to move on to the next patient. They stop at the foot of the bed, not quite knowing why they feel so reluctant to leave this patient. One of the nurses retraces her steps and touches the old lady's cheek. She looks down into the thousand-yard stare and a faint smile trembles on her parted lips. So much contained, so much understood; words fail miserably. Then she turns, sucks in the stale, sacrificial air and leaves, silently following her friend.

This short story seeks to capture the poignancy of a life that is drawing to its end, unravelling a plight steeped deep in abjection. Here, words become superfluous and presence, the only comfort. This end is the story of a beginning; a beginning that grows out of the overlap between care and art practice. One seeks to understand and reach out to the suffering other by creating new opportunities to do so. One needs to reveal ways to grow in awareness of all the narrative that is hidden below the surface of the ill self. This awareness will encourage the health care professional to bring to light and to expression all that the patient is ready to share, while being present to read between the lines of the patient's story. The scope of this review is thus to show that art can be used within the hospital and clinical setting, enabled by nurses themselves, as a way of sustaining empathic dialogue and acknowledging all that is unrepresentable and inarticulate in illness.

How does one start on a process that leads to understanding between two different disciplines? Gablik, a self-defined collage

artist, looks towards the process of synthesis that brings to light all the subtle, interconnecting thoughts, feelings and actions that define our existence (Volckmann, 2007). This is the ultimate integral theory: a collective view of the world that presents multiple dimensions whose porous boundaries allow us to transcend all divisions. In this paper, the process of synthesis is used to weave a web of relation. It is hoped that through the testimony and knowledge derived from both disciplines, that is, care and art practice, the practitioner will gain further insight into the empathic process and its relation to the 'lived' experience of illness.

This paper is approached from the transdisciplinary perspective that allows one to give priority to the process of synthesis, rather than to the one of analysis. This leads to an exploration of what brings different concepts together so as to gain understanding of their point of interaction. Thus, one becomes more concerned with traversing the spaces in between concepts rather than with the depth of conceptual detail. Such spaces are revealed through practice, whereby the professional, by finding the time to be present as empathic listener, allows the client to narrate his or her story.

2 The Path of Narrativity

Svенеaus (2011) identifies the path of narrativity by which to explore the temporality of illness. He proposes that illness has a temporal structure and that it can be conceptualised as an *alienation* of past and future. It is only the present that appertains to the self as illness creates a rupture from the past and possible future. Ricœur (1985, in Southall, 2013), in his book *Time and Narrative*, explains that in order for people to understand how their life has evolved, they need to create stories that serve to describe and enlighten their situation. In this way, they give an ordered sense to their experiences and relate their past to their present, in view of the possibilities of the future.

"Bodies are realized, not just represented but created, in the stories they tell," Frank (1997, p.52) reflects in his book *The Wounded Storyteller: Body, illness and ethics*. This medical sociologist explains that illness narratives serve as stories being told through the body and not about the body. This highlights the performative and transformative aspects of this sort of narrative. A story is not only about its lived element but also about the experience gained from its telling and its reception. It is not about how truthful it is but how, by its retelling, the narrator helps us finally get it right and understand what it means to the narrator (Komp, 1996).

Furthermore, Frank (1997) distinguishes between three different aspects of the illness narrative.

- *Chaos Narrative* This part of the story is mainly a lived experience since it cannot be totally disclosed by the patient as it reflects the absurd quality of illness. It is the space of seemingly futile suffering with no hope for redemption.

- *Restitution Narrative* This part of the narrative is about a re-envisioning by the patient of the past history and possible future that appertain to his individual being. By this, patients aim to give a new meaning to their life and, by doing so, come back to their own health.

- *Quest Narrative* This is the story of what the patient goes through, from dealing with the chaotic situation s/he has been thrown in to finally embodying a new possible meaning in life. It is about transformation and the embracing of a new identity.

Frank (1997) focuses on the wounded person as being the centre of care ethics in relation to illness, showing us that we have a responsibility towards the emotional and psychological welfare of the ill person. He also pushes forward the importance of considering people who are chronically ill and whose disabilities are not a temporary disruption but part and parcel of their life. In these cases, illness narratives serve to help the ill person engage freely in the creation of an individual meaning of illness. Once the ill person's need is defined, one must then understand the nurses'

perspective and how their position or stance influences the degree of closeness or distance allowed in their interaction with the patient.

3 The Nurse is Present

3.1 Exploring the closeness and distance continuum

"He whispers again, dragging the listening heart of the young nurse beside him to wherever his mind is, into that well of memory he kept plunging into during those months before he died" (Ondaatje, 1992, pp.3,4).

Being-there-for and being-with are aspects of relation that allow the health care professional to reach out to the patient and overcome boundaries that separate. The nurse is present by connecting with the patient. This is done through the interactive roles of listening and touch. One can listen by using 'connective touch', where the nurse is experienced as present by "being with" the patient. Listening also involves using 'task-oriented touch' where the nurse is present by "being there" for the patient (Fredriksson, 1999, p.1167).

'Caring' is fundamentally what nursing is all about (Leininger, 1986) and it is the culmination of thought, emotion and action that serve to address the needs of the patient (Bassett, 2002). A review of nurses' perception of care showed that for the professional nurse, the interpersonal aspects of the nurse-patient relationship are valued the highest, while patients value both the provision of physical care and the provision of emotional bonds that serve to provide comfort (Bassett, 2002).

Conceptualisation of nursing care reveals the essential traits of caring, all within the nurse's role: what the nurse does and what the nurse is. The traits include consideration, sensitivity, honesty, the 'general approach', 'giving of oneself' (Dyson, 1996), 'enabling' skills such as dedication, tact, cheerfulness, empathy, subtlety, humility and compassion, as well as intuitive knowledge that is an instinctive insight into the unspoken needs of the patient (Coulon et al., 1996). In a study by Bush and Barr (1997), critical care nurses perceived as the most valuable caring behaviour, the ability to listen to the patient. Touching and seeing the physical body of the patient, considered as the very essence of caring, places the nurse in a position of privilege vis à vis the patient. In a study on oncology nurses, it was revealed that knowing the patient and establishing a 'special' bond, even though this might not always occur between the nurse and patient, provides a source of strength for both the patient and the nurse. This intimate proximity helps the patient overcome boundaries, trust and open up to the nurse so as to expose their thoughts and fears (Rittman et al., 1997).

Considering this sort of exposure, in view of the bond shared between nurse and patient, leads one to reflect on the course of empathy and how it is relative to consciousness. Central to this association is Edmund Husserl's (1859-1938) phenomenological awareness of the human mind as not just simply residing within the confines of the physical brain but extending its reaches throughout the human body to overcome exterior boundaries of skin and enter the interpersonal world that surrounds the self (Thompson, 2001). Thus the human mind, being unconfined, consistently seeks to enter into dialogue not only with self but also with other. Thompson (2001) summarises the different aspects of this relation as being:

- *embodiment* - the mind is embodied within the physical self and also within its environment

- *emergence* - embodied cognition is made possible through the development of self-organised processes that interconnect mind, body and world

- *self-other co-determination* - the experience of feeling (affect) not only involves the whole brain but radiates to

incorporate the entire body; the affective mind becomes the affective body whereby the emergence of affective states happen in a reciprocally co-determined fashion.

The empathic dialogue between two people is thus built on an empathic 'recognition' of each other which provides the individual with a conscious recognition of the self as an embodied creature. Consciousness is thus a product of the interrelation of selves and is consequently intersubjective. This makes intersubjectivity an open process that is dependent on an empathic understanding of the self and of others as embodied beings. Steinbock (1964, in Thompson, 2001) emphasised that the only way in which people can actually be experienced is in their "mode of givenness". He calls the actual process (the way a person is given) "revelation". He also identifies love or compassion as being its enabler.

Thompson (2001) calls in the work of Edith Stein (1964), a German Jewish philosopher (Husserl's student), who wrote her thesis "on the problem of empathy" and who went on to become an eminent spiritual theologian. Considering Husserl's theory that the body as perceptual agent obstructs, in its physicality, the perception of self, Stein believed that through empathy, one gains another viewpoint. She believed that empathy is not a summative process but the holistic experience of another person. It involves a reaching out for the Other not as mere physical presence but as a living body. She talks of empathy as being reiterated, a way of grasping the self from another's perspective, thus allowing the person to experience the self from within and without.

According to Määttä (2006), Stein's concept of empathy (1916) is a synthesis of Martin Buber's (1955) and Carl Rogers' (1959) approaches to empathy. In Buber's book *Between Man and Man*, dialogue is given the primary mediating role whereby a process of 'crossing over' facilitates the space of 'shared meaning' between two people. This empathic relation happens naturally, spontaneously and in an uncontrived manner. On the contrary, Rogers' client-oriented theory is based on a shared meaning that occurs from a detached position and as a consequence of one's intention.

Due to nurses' fear of being engulfed by the patient's experience of pain and suffering, Määttä (2006) suggested that empathy within the therapeutic nurse-patient relationship can be related to Stein's (1916) concept of empathy, which comprises three levels:

I. Experiencing the other as object

This is a second-hand, intellectual experience of a person's emotions and feelings. This stage is characterised by active listening and an effort to put the self in the other's position.

II. Identification with the other

A merging of identities occurs with a deep understanding and awareness of the other (subject and object become one). This is an emotional, inter-human encounter with the lived quality of a parallel experience, yet still a non-primordial one.

III. Sympathy towards the other

A detachment occurs here and distance is reintroduced between the self and the other.

Määttä (2006) balanced patterns of closeness and distance using Stein's concept. This would help foster the degree of objectivity and control of self, associated with a professional stance. During the process of empathy, the nurse 'bears witness' to the patient by being actively engaged in listening for meaning. This will allow the evolution of the process of narration which helps the patient come to terms with the space of illness. It would also restore their individuality and connectedness with their life story, while encouraging them to reclaim their experience of illness from the medical metanarrative (Sakalys, 2003).

3.2 Exploring the presentable and unrepresentable continuum

When engaging in empathic dialogue with a patient, the nurse needs to be aware that, at times, there is an unidentifiable, unrepresentable gap in the space of relation. According to Cameron (2006), this gap is a consequence of the relation between the unrepresentable and the presentable as they come within "extreme proximity to the edges of human existence" (p.33). The nurse is called to embody the tension arising from this particular space, a space that is unaccounted for. In order to explore the unrepresentable-presentable continuum in nursing, Cameron (2006) points out that language is incapable of fully addressing this tension, because it strives to make articulate that which is unspeakable and will un-faillingly resist coming to light. She proposes instead the weaving of a co-text, that allows for the assimilation of the Other, so as to enable an intertextual reading of that which is being enacted. "We must bear witness to the hiddenness of the being of the other...we must resist hegemonic synthesis as we deal with individuals, families, communities, global areas where each have their own understanding of health and illness" (p.34).

Cameron (2006) brings to light the inherent subtleties associated with nursing practices such as the giving of bed baths and the endless acts of entering a patient's room or pulling a cubicle curtain that allow the nurse to witness this fragility, this exposure. In encountering the unrepresentable in others, nurses face the unrepresentable in their own selves. This, they need to endure while carrying on nursing the unrepresentable in others. The nurse is thus called to weave elemental acts of care that bear weight in a co-text that 'reads between the lines' of a patient's story, a story that is about broken and, at times, abject bodies.

4 The Artist is Present

4.1 Exploring the closeness and distance continuum

Marina Abramović is a performance artist whose latest work revolves around presence, embodiment and empathy as a healing experience. "Presence is the only reality we have, there is no other reality"; through the art of performance, "performer and the public become one form, one entity" explains Abramović in an interview with *The New Yorker* (Dylon-Robbins, 2013). Due to the ephemeral and empathic nature of performance, art becomes "a connective tissue between ways of being and seeing" (Tan, 2008, p.11). Tan picks on Sigmund Freud's concept of *deferred action* as a reciprocal relation between the occurrence of a significant event and its re-enactment or re-activation at a later stage in life. This concept shows that our receptive understanding of an important event necessitates the passage of time. This temporal delay is what makes one-to-one performance art, such as in *The artist is present*, a 2010 performance by Abramović which portrayed an intimate encounter based on empathic dialogue (see Figure 1). The actuality of the present moment is a shared witnessing between two people who activate the unconscious and tacit dialogue necessary to find a common and conscious articulation of personal meaning. The engaged self is now a proactive self who is no longer one of many but a person with identity. Thus, an intimate environment facilitates the reciprocal reading that takes place between the artist's self and the engaged self and between gaps of articulation. "...our act of giving voice to a shared silent ritual binds us intimately. A familiar and ordinary human activity is re-contextualized into an immersive interaction, to allow for new meanings and understanding to emerge from... the collective embodied foundation of our subjective consciousness" (Lu, 2008, p.21).

"Our capacity to pre-rationally make sense of the actions, emotions and sensations of others depends on embodied simula-

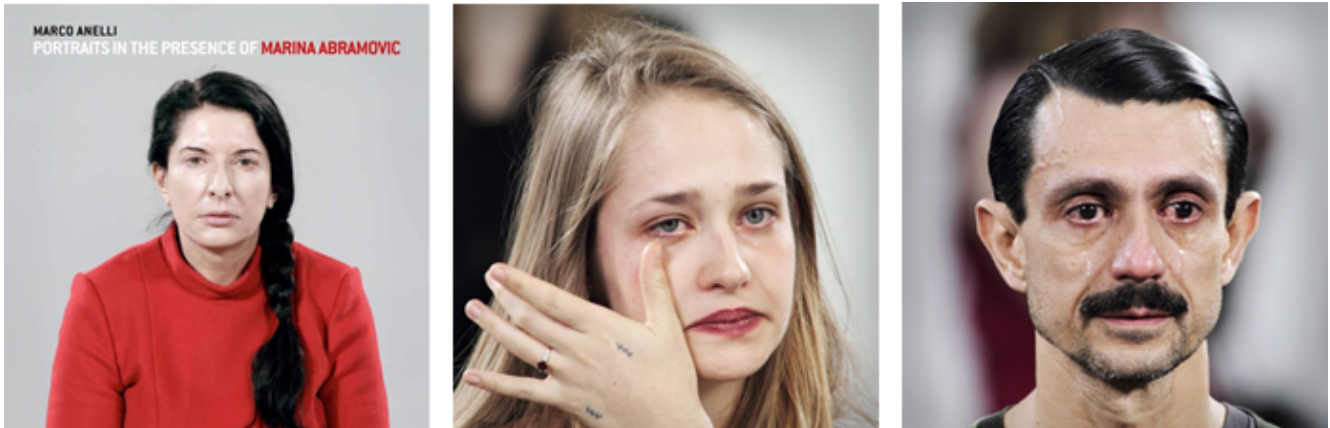


Figure 1: Photographs from the series *Portraits in the Presence of Marina Abramović*. Copyright ©2010 by Marco Anelli; reproduced with permission from Danziger Gallery, New York, United States.

tion, a functional mechanism through which the actions, emotions or sensations we see activate our own internal representations of the body states that are associated with these social stimuli as if we were engaged in a similar action or experiencing a similar emotion or sensation.” (Freedberg & Gallese, 2007, p.199)

The necessity for this simulation is explained by the presence of mirror neurons in our brain that encourage us to learn through imitation and grasp a better view of the surrounding world. An empathic attuning process, through which beings can empathise with others, results through the mediation of art (Frank, 2010). Thus, a subconscious mimicking of action or of motion dynamics present in art, whether performative or visual in nature, heighten the viewer’s emotional response to the tactile sensations in the work and bring about a further engagement with it. Zeki (2001) concludes that it is the natural predisposition of the artist to explore and understand how the viewer will react and interact with visual stimuli.

Sontag (2003) discerns between ways people react empathically to a visual experience. This is especially relevant to the nurse-patient relation. If a person reacts from a subjective point of view and associates the ‘self’ with the visual stimulus, then empathic engagement is experienced. If, on the other hand, the suffering person or performance artist is perceived as ‘other’, then the empathic response will be dulled. In a 1974 performance called *Rhythm 0*, one observes Abramović looking away from her body in a pained and detached way (Abramovich, 2013). One notes the indifference of the participating spectator who, allowed to do whatever he pleased to Abramović with an array of objects at his disposal, did not recognise himself in the other. Frank (2010) notes that trauma, whether visually experienced as art work or witnessed in traumatic situations such as war, or illness one may add, elicits different empathic responses and disturbs one’s mental wellbeing. He ties this in with the concept of vicarious traumatisation where the individual experiences traumatic stress by simply witnessing the trauma narrative.

5 Exploring the Presentable and Unpresentable Continuum

Performance art facilitates the corporeal experience of the body’s physical and perceptive dimension by exposing “the limits and excesses of the body (that take them to) loci of extremity, the nearest possible to the concept of death...which is the limit through which the horizon of exteriority can be contemplated” (Merewether, 1996, in Escoda Agustí, 2007, p.291). This is made tangible by the concept of abjection as defined by Kristeva (1982),

a critical theorist. Abjection is a subconscious reaction to one’s own subject that allows a bringing to light of one’s mortality. Abjection revolves around learnt rules and language that push the individual, from an early formative age, to engage in a social revulsion of the abject - that which can exist out of our body but which is also part of our body.

“Refuse and corpses show me what I permanently thrust aside in order to live...these body fluids, this defilement, this shit are what life withstands, hardly and with difficulty, on the part of death. There I am, at the border of my condition as a living being” (Kristeva, 1982, p.3). We recognise the abject around us in certain instances when meanings break down and the nonsensical enters our life. This throws order into havoc, identities into crises and systems into disorder. The abject is that which lies in the in-between, on the borders of familiarity (Frank, 2010).

The fleeting nature of artist Ana Mendieta’s (1948-1985) performances, as she negotiated earth-body boundaries, was registered in the intensity of the passing moment’s presence and aims to re-configure culturally conditioned ways of perceiving. Her agency allowed her to act in a world that is in a continuous state of becoming. She pushes the audience to appreciate subjective reaction, by undressing her own subjectivity and putting on the cloak of Otherness. By dwelling in the “abyss at the borders of the subject’s existence”, Mendieta takes on an abject identity, “an interstitial space between the person and the animal...between flesh and feathers” (Sandoval-Sánchez, 2005, p.547). This peripheral act of being makes carnal all that lies hidden and repressed within and which is eventually “transposed onto the feared Other” (Sandoval-Sánchez, 2005, p.547). This work is associated with sacrificial rituals carried out in Afro-Cuban communities so as to “restore a loss or heal an illness” (Escoda Agustí, 2007, p.294).

This temporal investigation, or negotiation, of ways of being in the world leads to an internal journey into intimate spaces, where the body becomes a means of interrogating, not only subjectivity and perception, but also ways of being ill (Morris, 2011). Such is the work of photographer and writer Alix Cléo Roubaud, who experienced her embodiment through the mediating role of an “incarcerating” asthma (Morris, 2011). This affected the artist’s agency by introducing physical limitations. The feeling of a slow suffocation exacerbated by any form of exercise impinged on what the artist could actually do, redefining her body’s relation to the world.

Leder (1990, in Svenaeus, 2000), in *The Absent Body*, describes how the isolating effects of pain and illness on daily routines leads to a *spatiotemporal constriction* that brings about self-reflection. This, in turn, leads to a re-evaluation of identity, an exploratory search into understanding the nature and place of illness and the

possibility of overcoming it. Roubaud's photographic testimony of embodied self bears witness to her struggle to give meaning to her illness. In one photo in particular, by placing the camera on her chest while lying down, she creates a dual portrait that captures a row of cypress trees (the outside world) and her own "asthmatic" breathing (her inside world). The cypress trees are a metonymy for her impending death and its causal illness. In this way, she symbolically negotiated the boundaries between the outside air and her internal breath (Morris, 2011).

6 The Mediation between Care and Art Practice

The fluctuating mediation between care and art practice leads to a crossing over from one area to another, a sort of trespassing of borders where ideas in one field are seen to echo in another. Philosopher Michel Serres in his book *Rome: A Book of Foundations* (1991, in Connor, 2002) explains that being 'in the middle of things' inherently signifies a process of mediation. In his discussion on time, Serres proposes the image of the baker kneading dough whereby time enters its folds and is constantly moulded. The process of folding over takes the fluctuating shape of organic structures rather than the rigidity of linear symmetry. This leads to a dynamic approach to thought processes, where interaction is 'kneaded' into being. This is in opposition to the idea of analysis which involves the separation of one thing from another.

Serres' milieu finds its fulfilment in-between channel and environment. Channels of communication, whether in a hospital context or a museum, are presented as "involutions of time and space, rather than simply movements between poles" (Serres, 1991, in Connor, 2002, p.3). Thus, mediating relationships between distance and closeness or the presentable and unrepresentable should be visually pictured in this way rather than as a linear dimension.

The point of interaction between care and art practice is precisely the need for empathic connection that allows the process of enquiry within the museum space and the process of narration within the hospital space. Kwon (2004) sums up the developing attributes of site-specific art seen as movement towards a concurrent dematerialisation of the site, together with a deaestheticisation and dematerialisation of the artwork. An appraisal of the artistic object and aesthetic experience gives way to an experience or process that provokes within the viewer an analytical reaction. The relationship between the art and the site is no longer permanent but transient and unrepeatable, being directed towards a more social and cultural critique that focuses on everyday life and related issues rather than its exclusivity.

If one looks at the site of interaction, the artist Helen Stratford (2002, in Thomas, 2009) considers the hospital space as being the product of its spacial gestures or spacial interactions that occur in relation to who occupies the space and where and how these occupied spaces interact. If one were to compare the hospital space with the 'non-places' of supermodernity, one would note certain similarities. Non-spaces are anonymous and transitory spaces that have a contractual nature and that are created in relation to a particular scope such as airport terminals, supermarkets and highways (Augé, 1995). One can extend this to include the hospital bed, where ill persons take on the identity of their bed number and are transferred from ward to surgery on the bed itself, whether or not they can physically walk the distance.

Within these spaces, unlike socially organic places, the individual relates with the self and with others, mainly through the mediation of text such as clinic hours and health-related campaigns or through a form of relation that seriously compromises one's autonomy and individuality. This places the individual consciousness in a new form of solitude, a kind of 'posture' that one experiences at the end of a movement that is a form of emptying of consciousness, a vacancy in one's gaze. Concurrent with

this solitude is the similitude that one experiences and which one shares with others using this non-place. They are measured in units of time, where the actuality of the space is so intense that it eradicates past and future. This paradox, this nowhere, includes the 'heterotopia' as portrayed by Foucault and Miskowiec (1986). Hospital life is so much in opposition to everyday life that it becomes contemporarily real and imagined...as if one is living a dream. Hospitals become *heterotopias of deviance*, which are designed in such a way so as to facilitate the treatment of bodies that deviate from what society considers a healthy state.

Art works within the clinical context work in opposition to this deviance by encouraging the exploration of perception and interpretation, thoughts and emotions through the narrative created by the artist (Haworth, 2007, in Edmonds & Hammond, 2012). This artistic research study also brought to light the potentiality of the nurses themselves, and not the artists, as process facilitators. Identification of coping mechanisms through a therapeutic alliance leads to positive meaning-making and emotional response, as well as kindling hope levels (Hass-Cohen & Clyde Findlay, 2009). Haworth (2007, in Edmonds & Hammond, 2012) explains that the availability of visual art can help bridge any distance between the health care giver and the receiver. It can help foster understanding of self and of others.

Although the conceptual development of the artwork *Sanctuary* (Baldacchino, 2014) (see Figure 2) is bound to the physical context of its use, it is not necessarily dictated by it. It was created for use within places of constraint such as hospitals and adapted to places of exchange such as exhibitory settings. The artwork became a mobile space that can be 'consumed' anywhere, making the primary site as elastic as its discursive one. This artwork also challenges the nature of artistic authorship, being designed so as to do away with the need for the artist to be an essential part of the process of its dissemination. The nurses in this case are given autonomy to handle the artwork themselves and use it as a way of triggering or encouraging the empathic process during therapeutic dialogue. However, it still highlights the role of the artist as a promoter or narrator, "because the signifying chain of site-oriented art is constructed foremost by the movement and decisions of the artist, the (critical) elaboration of the project inevitably unfolds around the artist" (Kwon, 2004, p.51). A recent shift from site-specificity to community-specificity, noted by Kwon (2004), pushes the artist to engage the audience, particularly marginalised ones, in the artistic process. Chronic and serious illness does in fact push the individual into a sort of exile, both socially and physically (as embodied experience). Falling under the title 'new genre public art', work in this area is centred on a humanitarian plight. Such work focuses on 'pleading the case' so as to create awareness of suffering endured by individuals within specific communities. The work *Sanctuary* (Baldacchino, 2014), humanitarian in essence, is thus concerned with social awareness, as is the exhibitory setting for the project. However, *Sanctuary* within the hospital/clinical setting (Figure 3) tries to go beyond this boundary by aiming to create understanding primarily for its user, the marginalised, the exiled and the alienated themselves.

7 Conclusion

As we turn to face each other, "the ethical and the spatial cannot be prised apart... this gives us our initial sense of a responsibility to something beyond us" (Morris, 2004, p.176). The nurse, in caring for the ill person, is thus called to look between scars and sutures, over crusts and wounds, around colostomies, drains, infusions, monitors, through necrotic, bileous smells and beyond blood, pus, vomit and excrement to understand and bear witness to profound acts of being, sometimes on the border between the here and there, so as to give empathic testimony to human suffering. Art as a powerful, symbolic language provides an invaluable tool to help sustain this process.

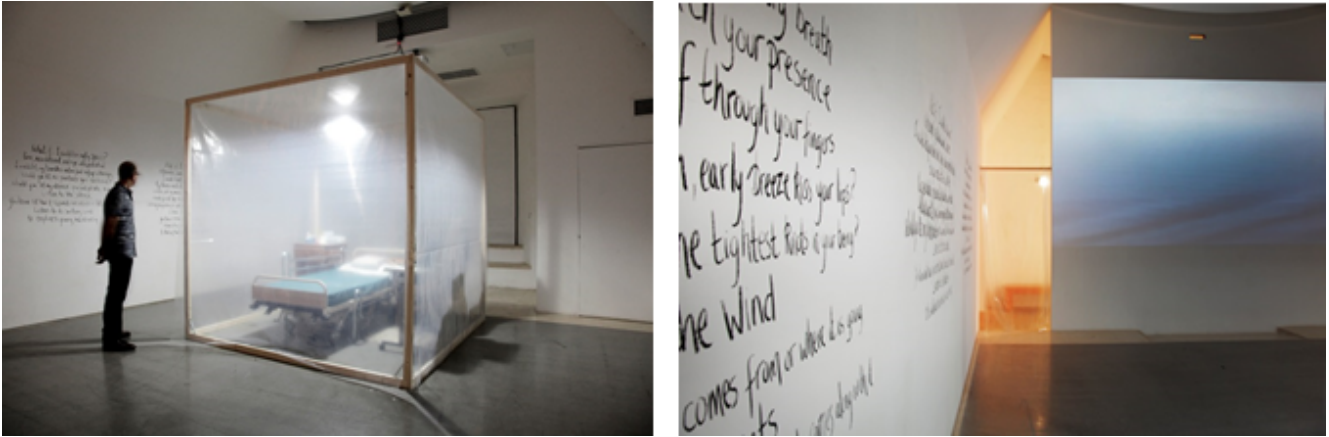


Figure 2: Installation views from *Sanctuary - Where is the Patient?* (Baldacchino, 2014) at the exhibition *Propolis: Artwork as Social Interstice*, St. James Cavalier, Valletta, Malta (photographs by Anna Runefelt).



Figure 3: *An Empathic Tool* from the series *Sanctuary* (Baldacchino, 2014) exhibited at St. James Capua Hospital, Sliema, Malta (photograph by Anna Runefelt).

8 Acknowledgements

I would like to thank Dr Raphael Vella B.Ed.(Hons), M.Ed., Ph.D.(Lond.), Senior Lecturer with the Department of Arts and Languages in Education at the Faculty of Education, University of Malta, for 'always bringing out the best in his students'.

9 Funding

This research has received no specific grant from any funding agency in the public, commercial or non-profit sector.

10 Conflicts of Interest

The author reports no conflicts of interest.

References

- Abramovich, M. (Maya Abramovich) (4th August 2013) *Art Marina Abramović Rhythm 0*. [Video file] [Online] Available from <https://www.youtube.com/watch?v=BwPTKmFcYAAQ> [Accessed 2nd March 2015]
- Ahlzén, R. (2011) Illness as unhomelike being-in-the-world? Phenomenology and medical practice. *Medicine, Health Care and Philosophy*, 14(3), pp.323-331.
- Augé, M. (1992) *Non-places: Introduction to an anthropology of supermodernity* (J. Howe, Trans.). London: Verso.
- Baldacchino, P. (2014) *Sanctuary* [Audio-visual installation]. Malta: University of Malta.
- Bassett, C. (2002) Nurses' perceptions of care and caring. *International Journal of Nursing Practice*, 8(1), pp.8-15.
- Bush, H. & Barr, W. (1997) Critical care nurses' lived experiences of caring. *Heart & Lung: The Journal of Acute and Critical Care*, 26(5), pp.387-398.
- Cameron, B. (2006) Towards understanding the unrepresentable in nursing: some nursing philosophical considerations. *Nursing Philosophy*, 7(1), pp.23-35.
- Connor, S. (2002) *Michel Serres's Milieux*. Extended version of paper presented at the ABRALIC (Brazilian Association for Comparative Literature) conference on 'Mediations', Belo Horizonte, July 23-26. [Online] Available from: <http://www.stevenconnor.com/milieux/> [Accessed 4th March 2014].
- Coulon, L., Mok, M., Krause, K. & Anderson, M. (1996) The pursuit of excellence in nursing care: what does it mean? *Journal of Advanced Nursing*, 24(4), pp.817-826.
- Dylon-Robbins, S. (10th October 2013) Video: Marina Abramović At Home. [Video file] [Online] Available from <http://www.newyorker.com/online/blogs/culture/2013/10/marina-abramovic-at-home.html> [Accessed 10th October 2013].
- Dyson, J. (1996) Nurses' conceptualizations of caring attitudes and behaviours. *Journal of Advanced Nursing*, 23(6), pp.1263-1269.
- Edmonds, K. & Hammond, M. F. (2012) How can visual arts help doctors develop medical insight? *International Journal of Art & Design Education*, 31(1), pp.78-89.
- Escoda Agustí, C. (2007) "I Carve Myself Into My Hands". The Body Experienced from Within in Ana Mendieta's Work and Migdalia Cruz's "Miriam Flowers". *Hispanic Review*, 75(3), pp.289-311.
- Frank, A. (1997) *The Wounded Storyteller: Body, illness and ethics*. Chicago: University of Chicago Press.
- Frank, A. (2010) *Letting Stories Breathe: A socio-narratology*. Chicago: University of Chicago Press.
- Fredriksson, L. (1999) Modes of relating in a caring conversation: a research synthesis on presence, touch and listening. *Journal of Advanced Nursing*, 30(5), pp.1167-1176.
- Foucault, M. & Miskowicz, J. (1986) Of other spaces: utopias and heterotopias. *Diacritics*, 16(1), pp.22-27.
- Freedberg, D. & Gallese, V. (2007) Motion, emotion and empathy in aesthetic experience. *Trends in Cognitive Science*, 11(5), pp.197-203.
- Komp, D. (1996) More than the sum of our scars. *Christianity Today*, April, p.33.
- Kristeva, J. (1982) *Powers of Horror: An essay on abjection* (L.S. Roudiez, Trans.). New York: Columbia University Press.
- Kwon, M. (2004) *One Place after Another, Site-Specific Art and Locational Identity*. London: MIT Press.
- Leininger, M. (1986) Care facilitation and resistance factors in the culture of nursing. *Topics in Clinical Nursing*, 8(2), pp.1-12.
- Lu, L. (2008) Resonant relationships: the one-to-one performance. In *Future of Imagination 5: International Performance Art Event, Singapore* (pp.16-19). [Online] Available from: <http://www.foi.sg/files/foi5catalog.pdf> [Accessed 15th January 2014].
- Määttä, S. M. (2006) Closeness and distance in the nurse-patient relation. The relevance of Edith Stein's concept of empathy. *Nursing Philosophy*, 7(1), pp.3-10.
- Morris, D. (2004) *The Sense of Space*. Albany: State University of New York Press.
- Morris, K. (2011) Illness, photography, and exile: the photography of Alix Cléo Roubaud. *RACAR: revue d'art canadienne / Canadian Art Review*, 36(2), pp.41-51.
- Ondjaate, M. (1992) *The English Patient*. Toronto: McClelland & Stewart.
- Rittman, M., Paige, P., Rivera, J., Sutphin, L. & Godown, I. A. (1997) Phenomenological study of nurses caring for dying patients. *Cancer Nursing*, 20(2), pp.115-119.
- Sakaly, J. A. (2003) Restoring the patient's voice. The therapeutics of illness narratives. *Journal of Holistic Nursing*, 21(3), pp.228-41.
- Sandoval-Sánchez, A. (2005) Politicizing abjection: in the manner of a prologue for the articulation of AIDS Latino Queer identities. *American Literary History*, 17(3), pp. 544-546.
- Sontag, S. (2003). *Regarding the Pain of Others*. New York: Farrar, Straus & Giroux.
- Southall, D. (2013) The patient's use of metaphor within a palliative care setting: theory, function and efficacy. A narrative literature review. *Palliative Medicine*, 27(4), pp.304-313.
- Svenaesus, F. (2000) The body uncanny - further steps towards a phenomenology of illness. *Medicine, Health Care and Philosophy*, 3(2), pp.125-137.
- Svenaesus, F. (2011) Illness as unhomelike being-in-the-world: Heidegger and the phenomenology of medicine. *Medicine, Health Care and Philosophy*, 14(3), pp.333-343
- Tan, A. (2008) Time and again: present-ing the future in the public of performance art. In *Future of Imagination 5: International Performance Art Event, Singapore* (pp.8-15). [Online] Available from: <http://www.foi.sg/files/foi5catalog.pdf> [Accessed 16th January 2014].
- Thomas, K. L. (2009) The other side of waiting. *Feminist Review*, 93(1), pp.122-127.
- Thompson, E. (2001) Empathy and consciousness. *Journal of Consciousness Studies*, 8(5-7), pp.1-32.
- Volckmann, R. (2007) Art and the future: an interview with Suzi Gablik. *Integral Review*, 5, pp.263-274.
- Zeki, S. (2001) Artistic creativity and the brain. *Science*, 293(5527), pp.51-52.

Research paper

INVESTIGATING THE EFFECT OF LONG-TERM MUSICAL EXPERIENCE ON THE AUDITORY PROCESSING SKILLS OF YOUNG MALTESE ADULTS

Martha Pace, Nadine Calleja

Department of Communication Therapy, Faculty of Health Sciences, University of Malta, Msida, Malta

Abstract. Learning and practising a musical instrument has recently been thought to ‘train’ the brain into processing sound in a more refined manner. As a result, musicians experiencing consistent exposure to musical practice have been suspected to have superior auditory processing skills. This study aimed to investigate this phenomenon within the Maltese context, by testing two cohorts of young Maltese adults. Participants in the musician cohort experienced consistent musical training throughout their lifetime, while those in the non-musician cohort did not have a history of musical training. A total of 24 Maltese speakers (14 musicians and 10 non-musicians) of ages ranging between 19 and 31 years were tested for Frequency Discrimination (FD), Duration Discrimination (DD), Temporal Resolution (TR) and speech-in-noise recognition. The main outcomes yielded by each cohort were compared and analysed statistically. In comparison to the non-musician cohort, the musicians performed in a slightly better manner throughout testing. Statistical superiority was surprisingly only present in the FD test. Although musicians displayed a degree of superiority in performance on the other tests, differences in mean scores were not statistically significant. The results yielded by this investigation are to a degree coherent with implications of previous research, in that the effect of long-term musical experience on the trained cohort manifested itself in a slight superiority in performance on auditory processing tasks. However, this difference in scoring was not prominent enough to be statistically significant.

Keywords: auditory processing, musical training, malleability, auditory system

1 Introduction

Auditory processing shapes the way meaningful acoustic information, including speech sounds, is extracted from complex acoustic stimuli (Banai & Kraus, 2007). The processing of auditory information is said to have an intricate plasticity which may be

Correspondence to: Martha Pace
(martha.pejs@gmail.com)

Received: 16.07.14 - Revised: 25.11.14 - Accepted: 09.12.14 -
Published: 25.05.15

© 2015 The authors

adaptable to experience, training and environmental change (Zendel & Alain, 2012). Research has suggested that acoustic training results in functional and structural changes in the auditory system (Hannon & Trainor, 2007). Furthermore, researchers have hypothesised that as physical training shapes one’s physical fitness, music may shape ‘auditory fitness’ (Chandrasekaran & Kraus, 2010).

Musical training involves constant judgement of acoustic sounds according to their frequency, timing and overall quality. These factors happen to be the basic components by which sounds, ranging from meaningless tones to speech sounds, are processed (Kraus et al., 2009). Musical training could therefore be a tool which ‘sharpens’ the auditory processing system, with trained musicians excelling in auditory processing tasks due to their expertise within the area.

The current study investigates the effects of long-term musical training in Maltese adults. It aims to identify discrepancies, if any, in the performance of long-term musicians and non-musicians aged 19 to 31 in Frequency Discrimination (FD), Duration Discrimination (DD), Temporal Resolution (TR) and speech-in-noise recognition.

2 Methods

Ethical approval for this research study was obtained from the University of Malta Research Ethics Committee. Prior to testing, the participants were presented with Maltese and English versions of an information sheet on the course of the assessments and what their participation in the investigation would entail. The information sheet also described the purpose of the research and specified the individual subtests to be administered, while assuring that confidentiality of the participants would be respected during and following completion of the study.

2.1 Participant recruitment

The selection criteria for the study participants were as follows:

- the participant had to be a native Maltese speaker
- the participant had to be between 19 and 31 years of age
- the participant had to have a normal range of hearing (0 dB to 25 dB)
- the participant had no history of Auditory Processing Disorder (APD).

The subjects selected for this study were divided into two cohorts and referred to as musicians and non-musicians. Subjects assigned to the musician cohort were:

- individuals whose musical experience started by the age of 9 and had been consistent throughout their lifetime
- individuals who engaged in musical practice for three or more times a week within the previous three years.

Individuals who failed to meet any of these criteria were neither classified as a musician nor as a non-musician. The non-musician cohort was made up of individuals meeting the general criteria, but completely lacking a history of musical training.

A screening checklist was given to individuals who gave their consent for participation. This tool, adapted from a checklist for children with auditory processing issues (Calleja, n.d.), was used as a means of deciding whether the participants showed behaviours related to APD. Individuals showing a significant number of APD traits were not included in the research sample.

An Interacoustics®AC33 clinical audiometer was used to determine the participants' hearing threshold and to ensure that hearing was of a normal range (0 dB to 25 dB). Air-conduction testing was carried out, involving presentation of the pure tone to each ear independently through specialised headphones (Aras, 2003).

2.2 Pilot study

During the pilot study phase, two individuals who satisfied the general criteria, but could not be classified in any of the subject cohorts, were tested. Following the pilot study, amendments to the environment in which the tests were carried out were made. The air-conditioning system was switched off during testing, eliminating disturbances brought about by background noise.

2.3 Data collection

Of the 24 participants who satisfied the general criteria, 14 subjects were grouped in the musician cohort, whilst 10 subjects were grouped in the non-musician cohort. The data collection phase required the use of a desktop computer which presented the auditory stimuli, the Interacoustics®AC33 clinical audiometer through which the stimuli were presented and specialised headphones which delivered the sound stimuli to the participant. Selected areas of the domain of auditory processing were assessed for each participant, as shown in Table 1.

2.3.1 The Frequency Pattern Test (FPT)

The Frequency Pattern Test (FPT) is a central auditory processing test assessing FD (Musiek, 1994). Participants were exposed to a series of three tones through headphones, with each tone having a 200 ms duration with an inter-stimulus interval of 150 ms. Each tone could be of a high pitch (1122 Hz) or a low pitch (880 Hz). This test was administered at a 50 dB level, presenting 30 stimuli to each ear. Participants were exposed to five practice items prior to initiation of the test. Following each series of three tones, participants were asked to identify the pattern of high and low tones in the correct order through verbal responses (labelling tones as 'high' and 'low' accordingly). Inter-pattern intervals were allotted in order to provide sufficient time for a response. The total amount of correct responses was calculated.

2.3.2 The Duration Pattern Test (DPT)

During the Duration Pattern Test (DPT), each participant was exposed to a series of three pure tones at 1000 Hz which were separated by 300 ms. Each tone was either of a long (500 ms) or a short (250 ms) duration. Following each three-tone series, the participant was expected to verbally describe the sequence heard. This test was administered at 50 dB, presenting 33 three-tone series in each ear. The participant was exposed to five practice items prior to initiation of testing. Time for response was allotted between each three-tone sequence. The correct identification attempts were scored following assessment.

2.3.3 Gaps-in-Noise (GIN) Test

The Gaps-in-Noise (GIN) Test assessed the participants' TR (Prem, Shankar & Girish, 2012). Use was made of two lists (Test 2 and Test 3) which were referred to as comparable and reliable (Prem et al., 2012). One list was carried out for each ear. Each test is composed of a series of 6s noise segments. Following each white noise and silence gaps segment, participants were asked to recite the number of gaps heard. The participants' performance was scored on the GIN Score Sheet (Musiek et al., 2005).

2.3.4 The Test for Non-Word Repetition in Noise: Maltese and English versions

During both language versions of the Non-Word Repetition in Noise Test, the participants were asked to listen to an audio-recording of non-words at an intensity of 50 dB HL and a signal-to-noise ratio of 5 dB. The participants were asked to repeat the non-word heard. This procedure was used for both English and Maltese non-words. The respective amounts of errors made in both tests were noted and classified as omission, articulation or reversal errors.

2.4 Data analysis

The IBM SPSS Statistics software was used for statistical analysis of the quantitative data collected. An expert statistician assisted statistical analysis.

The Kolmogorov-Smirnov Test was used to determine whether the mean scores obtained during testing had a normal distribution. The Null Hypothesis (H_0) for the Kolmogorov-Smirnov Test specifies that the score distribution is normal and is accepted if the p -value exceeds the 0.05 level of significance. The Alternate Hypothesis (H_1) specifies that the scores achieved have a skewed, non-normal distribution and is accepted if the p -value is less than the 0.05 criterion. The Independent Samples T-test and the Mann-Whitney Test were used to compare mean scores of two independent groups (musicians and non-musicians). For normally distributed scores, the Independent Samples T-test (parametric test) was used to compare mean scores obtained by musicians and non-musicians. The Mann-Whitney Test (non-parametric test) was used to compare mean scores when the score distribution was not normal (p -value < 0.05).

Table 1. Auditory processing skills investigated

Test	Auditory Processing Skill
The Frequency Pattern Test (FPT) (Musiek, 1994)	Frequency Discrimination (FD)
The Duration Pattern Test (DPT) (Musiek, 1994)	Duration Discrimination (DD)
The Gaps-in-Noise (GIN) Test (Musiek et al., 2005)	Temporal Resolution (TR)
Test for English Non-Word Repetition in Noise (Calleja, n.d.)	Speech-in-noise
Test for Maltese Non-Word Repetition in Noise (Calleja, n.d.)	Speech-in-noise

3 Results

Table 2 summarises the outcomes of the Kolmogorov-Smirnov Test and specifies the statistical tests used to compare mean scores obtained by the participating cohorts.

Table 3 summarises H_0 and H_1 for the tests carried out during this investigation. The p -value deduced from either the Independent Samples T-Test or the Mann-Whitney Test determined whether H_0 or H_1 was accepted. If the p -value exceeded the 0.05 criterion, H_0 was accepted. On the other hand, if the p -value was less than the 0.05 criterion, H_1 was accepted.

Table 4 summarises the results obtained following statistical analysis of the FPT scores. The mean number of correct responses made by the musician and non-musician cohorts differed significantly (H_1 was accepted), with musicians scoring an average of 59.86 responses and non-musicians scoring a mean of 53.40 from 60 possible correct responses.

Table 5 summarises the results obtained following statistical analysis of DPT scores. The average number of correct responses made by the two participating cohorts was considered to be comparable (p -value marginally exceeded the 0.05 criterion).

Table 2. Normality of distribution test outcomes and implications for statistical tests to be employed

Test	Kolmogorov-Smirnov Test outcome	Independent Samples T-Test	Mann-Whitney Test
FTP	Non-normal		✓
DTP	Non-normal		✓
GIN Test: List 2	Non-normal		✓
GIN Test: List 3	Normal	✓	
Maltese Non-Word Repetition in Noise	Normal	✓	
English Non-Word Repetition in Noise	Non-normal		✓

Table 3. H_0 and H_1 for the testing procedure

Test	H_0	H_1
FTP	The mean numbers of correct frequency patterns guessed by musicians and non-musicians are comparable	The mean numbers of correct frequency patterns guessed by the two groups differs significantly.
DTP	The mean numbers of correct responses made by the two cohorts during the DPT are comparable	The mean numbers of correct responses made by the two cohorts during the DPT differ considerably.
GIN Test (Lists 2 & 3)	The mean numbers of detected gaps made by the two cohorts during the GIN Test are comparable.	The mean numbers of detected gaps made by musicians and non-musicians during the GIN test differ significantly.
Test of Non-Word Repetition in Noise (Maltese & English)	The mean number of errors made by musicians and non-musicians is comparable.	The mean number of errors made by the two groups differs significantly.

Table 4. Summary of Mann-Whitney Test outcomes (Frequency Pattern Test (FPT))

Cohort	Sample Size	Mean	Std. Dev.	p -value
Musicians	14	59.86	0.535	<0.001
Non-Musicians	10	53.40	8.208	

Table 5. Summary of Mann-Whitney Test outcomes (Duration Pattern Test (DPT))

Cohort	Sample Size	Mean	Std. Dev.	p -value
Musicians	14	62.64	3.478	0.056
Non-Musicians	10	56.40	7.981	

Table 6. Summary of Mann-Whitney Test outcomes (Gaps-in-Noise (GIN) Test: List 2)

Cohort	Sample Size	Mean	Std. Dev.	p -value
Musicians	14	48.57	6.309	0.158
Non-Musicians	10	46.30	6.219	

Table 7. Summary of Independent Samples T-Test outcomes (Gaps-in-Noise (GIN) Test: List 3)

Cohort	Sample Size	Mean	Std. Dev.	p -value
Musicians	14	49.57	6.880	0.257
Non-Musicians	10	46.40	6.114	

Table 8. The Independent Samples T-Test outcomes (Non-Words in Noise: Maltese)

Cohort	Sample Size	Mean	Std. Dev.	<i>p</i> -value
Musicians	14	11.07	5.166	0.281
Non-Musicians	10	13.00	2.211	

Table 9. The Mann-Whitney Test outcomes (Non-words in Noise: English)

Cohort	Sample Size	Mean	Std. Dev.	<i>p</i> -value
Musicians	14	12.00	3.700	0.616
Non-Musicians	10	12.80	4.686	

Table 6 summarises the results obtained through statistical analysis of the scores obtained by both cohorts on List 2 of the GIN Test. H_0 for the GIN Test was accepted, deeming the mean scores obtained by the participating cohorts as comparable. The mean number of correct responses made by musicians (48.57) was only slightly higher than that achieved by non-musicians (46.30).

Table 7 summarises the results obtained following statistical analysis of the scores obtained by both cohorts on List 3 of the GIN Test. Since the *p*-value exceeds the 0.05 criterion, H_0 was accepted, suggesting that the mean number of correct responses was comparable.

Following completion of Lists 2 and 3, outcomes were analysed to obtain the Threshold of Gap Detection, which is the smallest time interval in which a continuous time interval is interrupted (Musiek et al., 2005). The Mann-Whitney Test accepted H_0 , suggesting that the means of Threshold of Gap Detection achieved by the participating cohorts were similar. The Threshold of Gap Detection for each cohort was consistent through both lists. This is understandable since these lists are described as comparable sections of the GIN Test (Prem et al., 2012).

Table 8 summarises the results obtained following statistical analysis of the scores obtained during the Maltese Non-Word Repetition in Noise Test. Since the *p*-value obtained exceeded the 0.05 criterion (0.281), H_0 was accepted, verifying that the mean number of errors made by musicians and non-musicians was comparable and did not differ in a significant manner.

Table 9 summarises the results of statistical analysis of the scores obtained during the English Non-Word Repetition in Noise Test. Since the *p*-value exceeded the 0.05 criterion (0.616), the results achieved by musicians and non-musicians were treated as comparable since the means only differed marginally.

4 Discussion

This investigation targeted four primary areas of auditory processing: FD, DD, TR and speech-in-noise recognition. The reasoning behind the selection of these areas was based on the notion that musicians identify meaningful acoustic patterns within sound stimuli through musical practice. In the light of previous studies, it was hypothesised that musicians are more attuned to judging meaningful speech sounds in the presence of background noise (Barrett et al., 2013). Musicians were also expected to be more accustomed to identifying changes in frequency and rhythm than non-musicians (Strait et al., 2013).

Strait et al. (2013) also suggested that in long-term musicians who started musical training during their childhood (as in the case of the participating musician cohort), frequency and duration discrimination as well as gap-detection develop distinctively during neural development and combine to result in an improvement of speech-in-noise perception. The tested auditory processing skills may therefore ‘co-exist’, resulting in a heightened recognition of speech in background noise. The general results of this study challenge these views, since this ‘superiority’ of musicians was only

observed to be of a marginal nature. This slight superiority may have contributed to resilience of speech recognition in background noise, resulting in a slight advantage for musicians in the final Test of Non-Word Repetition in Noise.

4.1 Frequency Discrimination outcomes

In this investigation, the discrepancy in cohort performance was mostly evident in the FD task, which was the only tested area generating statistically significant results. FD is an auditory processing skill which forms one of the primary dimensions common throughout musical production styles (Krumhansl, 2000). It is therefore impossible to engage in musical training without practising FD skills, regardless of the instrument or musical genre practised. In fact, brain scan comparisons between musicians and non-musicians have suggested that active practising of FD skills resulted in musicians’ more refined response to frequency changes during speech at a sub-cortical level (Wong et al., 2007). This ‘refinery’ reflected itself in the outcomes of this investigation, since musicians particularly excelled during this test by scoring a mean of 59.86 out of 60 possible correct responses whilst the non-musician cohort scored a mean of 53.40.

The outcomes of FD testing were also coherent with previous research, implying that musicians’ superiority stems from the notion that musical training keeps the musician ‘cognitively exposed’ and ‘attuned’ to detect even miniscule frequency changes (Kishon-Rabin et al., 2001). This is an important factor for communication since efficient FD could enable the individual to detect meaningful pitch changes during speech, supporting ‘refined’ verbal comprehension (Nagle & Musiek, 2009).

The remaining outcomes yielded during this investigation were not of a statistically significant nature, potentially due to the limited sample size used for testing or the fact that differences in cohort performance were not as robust as expected. Even though marginal at instances, a discrepancy in performance was still present in the outcomes of each administered test. Comparison of test outcomes suggests agreement with the proposition that musicians exhibit an ‘edge’ over non-musicians in auditory processing skills (Kraus, 2011). Considering that the ‘edge’ exhibited was not as well-defined as expected, the outcomes challenge the idea that ongoing practice does in fact refine auditory processing skills.

4.2 Duration Discrimination outcomes

During musical performance, musicians are found to attain precise DD. A positive relationship between the ability to excel musically and the ability to discriminate duration changes has been supported by recent research deeming DD a vital attribute of distinguished musical ability (Rammesayer, Buttkeus & Altenmüller, 2012). The results yielded by this study suggest that musicians were in fact slightly more proficient (62.64) than non-musicians (56.40). However, this raises the following question: if FD and DD are both vital for musical production (Krumhansl, 2000; Rammesayer et al., 2012), for what reason did the musician cohort only

perform significantly in FD testing?

Musical sounds result in a more powerful response rate than brief and abstract tones (Krumhansl, 2000). The use of brief and abstract tones during the testing procedure may have yielded results which do not fully reflect the musician cohort's potential, although brain scan research shows that a musician's brain still responded to simple artificial tones more effectively than non-musicians (Peretz & Zatorre, 2005). Using tones during this testing was considered to be beneficial, since it eliminates pre-set advantages for the musician cohort (Lim & Sinnett, 2012).

4.3 Temporal Resolution outcomes

Similar abstract stimuli were used during TR testing via the GIN Test. Although musicians detected more silent gaps than non-musicians, the discrepancy of outcomes between the participating cohorts was not statistically significant. This ultimately suggests that musicians and non-musicians do not differ significantly in their level of performance in TR tasks.

The outcomes of the current study followed the pattern of results obtained from an investigation focusing on discrepancies in TR skills using the GIN Test on a limited research sample (Martinez Monteiro et al., 2010). The resemblance between the different result sets may be attributed to the fact that both studies tested a limited sample size. Although musicians exhibited more refined skills in identifying silence gaps, the discrepancies, registered in both studies, were not statistically significant.

Outcomes for this section of testing suggested that musicians may be slightly better in TR tasks, and also exhibit a smaller gap detection threshold in comparison to non-musicians. Musicians may therefore only be able to detect a marginally smaller silence gap than non-musicians. The ability to detect smaller silence gaps indicates refined auditory acuity, which is a critical skill for accurate decoding of speech sound detection in background noise (Sangamanatha et al., 2013).

4.4 Speech-in-noise recognition

This slight 'accurate decoding' was reflected in the final test which assessed speech-in-noise recognition. This test was meant to ultimately determine which cohort would be more efficient in understanding speech in the presence of background noise. Participants were tested using non-words so as to eliminate the variability caused by guessing of words. Discrepancies were however not of a statistically significant nature. Musicians made fewer errors in comparison to non-musicians in both Maltese- and English-based non-words. This remained true to research focused on this area which suggests that following life-long training, adults experienced gains in speech-in-noise perception, whereas non-musicians experienced no such gains (Anderson et al., 2013; Strait et al., 2013; Tierney et al., 2013).

It is important to note the outcomes observed for both the Maltese- and English-based non-words achieved by both cohorts. Although musicians manifested the least amount of errors in both cases, there was a general increase in errors during the English version of the test. An explanation for this difference could be that the selection criteria required the subjects' first language (L1) to be Maltese. Previous research targeting speech-in-noise recognition in Spanish and Dutch users of English stated that the difficulty of listening to speech-in-noise is intensified when the speech is in the listeners' second language (L2) rather than their L1 (Cutler et al., 2007).

The types of errors made were divided into three categories for both L1 and L2: articulation, omission and reversal. Interestingly, although the mean numbers of errors were slightly different between languages (more errors in L2) and cohorts (superior performance by musicians), the ranking of errors seemed to be consistent in all outcomes. Errors were mainly articulation er-

rors, followed by omission errors, with reversal errors being the rarest type of errors. The difference in types of errors, with non-musicians exhibiting a higher amount of errors, could be explained by research literature that suggests that trained musicians show more distinct neural encoding of stop consonants (Strait et al., 2013). This response corresponds to consonant-vowel transitions (Miller & Nicely, 1955), which accounted for the decrease in likelihood of errors for the musician cohort.

The musician cohort was composed of individuals who had life-long exposure to music, experiencing 'heightened stimulation' during 'sensitive periods' of development. The advantages of this exposure were observed marginally throughout the test outcomes as musicians performed in a slightly better manner than non-musicians. As implied by these outcomes, strengthened distinction of frequency, duration and temporal resolution strengthened speech-in-noise recognition (Strait et al., 2013).

Previous research suggested that refinements result in fine-tuning of acoustic features of musical sounds which can be assumed to occur equally for musical sounds and speech sounds (Chandrasekaran & Kraus, 2010) due to the overlap between processing of language and music (Chan, Ho & Cheung, 1998; Menon & Levitin, 2005; Patel, 2011; Tallal & Gaab, 2006). Due to this overlap, musical training could serve as a training ground for the development of language skills including verbal memory, verbal intelligence, attention (Chan et al., 1998; Tallal & Gaab, 2006) and literacy skills (Foregaurd et al., 2008).

Music training has also been suspected to aid in refining the perception of minute acoustic differences that distinguish sounds, which may be extended to the processing of speech (Strait et al., 2013). This was supported by the outcomes of this study which highlighted musicians' superiority in speech-in-noise detection. The ability to 'rise above' background noise in speech understanding broadens the chances of the individual to succeed academically (Tierney et al., 2013). Long-term musical training equips the musician with the advantage of heightened auditory processing abilities which translate into superior speech-in-noise perception, language-related abilities and academic performances (Parbery-Clark et al., 2009; Tierney et al., 2013).

4.5 Limitations

Due to the strict nature of the subject selection criteria, the number of participants tested was rather limited. The use of smaller sample sizes may jeopardise the precision of estimates, producing a familiar decrease in statistical power as the sample decreases (Ware & Brewer, 1999). The *p*-value yielded through statistical analysis is heavily dependent on sample size. Seeing that the sample size for this study was limited and the scores obtained by the cohorts tested did not exhibit prominent differences, it was highly unlikely that the discrepancy between scores by musicians and non-musicians was considered significant following statistical analysis.

5 Conclusions

Since this investigation tested a limited sample size and musicians' and non-musicians' scores were only marginally different, it was challenging for this study to be significantly conclusive on the various points that surfaced following data analysis. Regardless of the fact that not all the test results were of statistical significance, this study provided insightful indications which could be a source for further research in this field.

Musicians performed better throughout the testing procedure when compared with the non-musician cohort. Although this superiority was marginal, musicians presented the hypothesised 'edge' (Kraus, 2011) over non-musicians in being successful during auditory processing tasks. The discrepancies in performances were not as significant as this study had hypothesised. However, following analysis of the data collected, it is highly likely that life-

long experience within the musical field manifested itself in refined auditory processing abilities which were exhibited throughout the course of testing.

The auditory processing skills tested, namely FD, DD, TR and speech-in-noise recognition have implications for the resilience of the individual as both a functional communicator and a successful academic being (Menon & Levitin, 2005; Patel, 2011). Musical training may thus benefit individuals not only in their auditory well-being, but also in their ability to exploit their full potential.

The indications drawn by this investigation could be further explored through a larger-scale study testing a larger sample size. Since similar studies have not been previously carried out in Malta, a similar procedure could be adopted for different age groups. Studying the effects of musical training on auditory processing skills may also be related to subsequent academic success rate. Positive findings within this area could promote musical training as a learning skill. Since this study tested limited ranges of auditory processing skills, it would also be useful to administer a full test battery across cohorts of lifelong musicians and non-musicians to gain a more holistic view of the effects of long-term musical training on auditory processing skills.

6 Funding

This research has received no specific grant from any funding agency in the public, commercial or non-profit sectors.

7 Conflicts of Interest

The authors report no conflicts of interest.

References

- Anderson, S., White-Schwoch, T., Parbery-Clark, A. & Kraus, N. (2013) Reversal of age-related neural timing delays with training. *Proceedings of the National Academy of Sciences*, 110(11), pp.4357-4362.
- Aras, V.P. (2003) *Audiometry techniques, circuits and systems*. M. Tech. Credit Seminar Report, Electronic Systems Group, EE Department, Bombay.
- Banai, K. & Kraus, N. (2007) Auditory processing malleability: focus on language and music. *Current Directions in Psychological Science*, 16(2), pp.105-109.
- Barrett, K.C., Ashley, R., Strait, D.L. & Kraus, N. (2013) Art and science: how musical training shapes the brain. *Frontiers in Auditory Cognitive Neuroscience*, 4, 713. doi: 10.3389/fpsyg.2013.00713.
- Calleja, N. (n.d.) *Questionnaire of (Central) Auditory Processing*. Unpublished questionnaire. Malta: University of Malta.
- Calleja, N. (n.d.) *Test of English Non-Word Repetition in Noise*. Unpublished assessment. Malta: University of Malta.
- Calleja, N. (n.d.) *Test of Maltese Non-Word Repetition in Noise*. Unpublished assessment. Malta: University of Malta.
- Chan, A., Ho, Y. & Cheung, M. (1998) Music training improves verbal memory. *Nature*, 396(6707), p.128.
- Chandrasekaran, B. & Kraus, N. (2010) Music training for the development of auditory skills. *Nature Reviews Neuroscience*, 11(8), pp.599-605.
- Cutler, A., Cooke, M., Garcia Lecumberri, M.L. & Pasveer, D. (2007) *L2 Consonant Identification in Noise: Cross-language comparisons*. Antwerp: Interspeech.
- Foregeard, M., Winner, E., Norton, A. & Schalaus, G. (2008) Practicing a musical instrument in childhood is associated with enhanced verbal ability and nonverbal reasoning. *PLoS ONE*, 3(10), e3566. doi:10.1371/journal.pone.0003566.
- Hannon, E. E. & Trainor, L. J. (2007) Music acquisition: effects of enculturation and formal training on development. *Trends in Cognitive Science*, 11(11), 466-472.
- Kishon-Rabin, L., Amir, O., Vexler, Y. & Zaltz, Y. (2001) Pitch discrimination: Are professional musicians better than non-musicians? *Journal of Basic and Clinical Physiology and Pharmacology*, 12(1), pp.125-143.
- Kraus, N. (2011) Musical training gives edge in auditory processing. *Hearing Journal*, 64(2), pp.10-16.
- Kraus, N., Skoe, E., Parbery-Clark, A. & Ashley, R. (2009) Experience-induced malleability in neural encoding of pitch, timbre and timing: implications for language and music. *Annals of the New York Academy of Sciences: Neurosciences and Music*, 1169(3), pp.543-557.
- Krumhansl, C.L. (2000) Rhythm and pitch in music cognition. *Psychological Bulletin*, 126(1), pp.159-179.
- Macklin, D.S., Smith, L.A. & Dollard, M.F. (2006) Public and private sector work stress: workers' compensation, levels of distress and job satisfaction, and the demand-control-support model. *Australian Journal of Psychology*, 58(3), pp.130-143.
- Lim, A. & Sinnett, S. (2012) Multimodal temporal perception in musicians: evidence for both segregated and supramodal attentional systems? In N. Miyake, D. Peebles & R. P. Cooper (Eds) *Proceedings of the 34th Annual Conference of the Cognitive Science Society* (pp.1906-1911). Austin, TX: Cognitive Science Society.
- Martinez Monteiro, R.A., Martins Nascimento, F., Debus Soares, C. & Dornelles da Costa Ferreira, M.I. (2010) Temporal resolution abilities in musicians and non-musicians. *International Archives of Otorhinolaryngology*, 14(3), pp.302-308.
- Menon, V. & Levitin, D. (2005) The rewards of music listening: response and physiological connectivity of the mesolimbic system. *NeuroImage*, 28(1), pp.175-184.
- Miller, G.A. & Nicely, P.E. (1955) An analysis of perceptual confusions among some English consonants. *The Journal of the Acoustical Society of America*, 27(2), pp.338-352.
- Musiek, F.E. (1994) Frequency (pitch) and duration pattern tests. *Journal of the American Academy of Audiology*, 5(4), pp.265-268.
- Musiek, F.E., Shinn, J.B., Jirsa, R., Bamiou, D.E., Baran, J.A. & Zaidan, E. (2005) Gaps-in-Noise (GIN) test performance in subjects with confirmed central auditory nervous system involvement. *Ear & Hearing*, 26(6), pp.608-618.
- Nagle, S. & Musiek, F.E. (2009) Frequency discrimination and (C)APD. *Hearing Journal*, 62(2), p.36.
- Parbery-Clark, A., Skoe, E., Lam, C. & Kraus, N. (2009) Musician enhancement for speech in noise. *Ear and Hearing*, 30(6), pp.653-661.
- Patel, A. (2011) Why should musical training benefit the neural encoding of speech? *Frontiers in Psychology*, 2, p.142. doi:10.3389/fpsyg.2011.00142
- Peretz, I., & Zatorre, R. J. (2005) Brain organization for music processing. *Annual Review of Psychology*, 56, 89-114.
- Prem, G., Shankar, N.S. & Girish, N. (2012) Gaps in noise (GIN) test - normative data. *Amrita Journal of Medicine*, 8(1), pp.1-44.
- Rammsayer, T., Buttkus, F. & Altenmüller, E. (2012) Musicians do better than non-musicians in both auditory and visual timing tasks. *Music Perception*, 30(1), pp.85-96.
- Sangamanatha, A.V., Fernandes, J., Bhat, J., Srivastava, M. & Udupa, P.S. (2013) Temporal resolution in individuals with and without musical training. *Journal of Indian Speech Language & Hearing Association*, 26(1), pp.27-35.
- Strait, D.L., O'Connell, S., Parbery-Clark, A. & Kraus, N. (2013) Musicians' enhanced neural differentiation of speech sounds arises early in life: developmental evidence from ages three to thirty. *Cerebral Cortex*. doi:10.1093/cercor/bht103.
- Tallal, P. & Gaab, N. (2006) Dynamic auditory processing musi-

- cal experience and language development. *Trends in Neurosciences*, 29(7), pp.382-390.
- Tierney, A., Krizman, J., Skoe, E., Johnston, K. & Kraus, N. (2013) High school music classes enhance the neural processing of speech. *Frontiers in Educational Psychology*, 4, 855. doi:10.3389/fpsyg.2013.00855.
- Ware, E.W. & Brewer, C.L. (1999) *Handbook for Teaching Statistics and Research Methods*. New Jersey: Lawrence Erlbaum Associates.
- Wong, P.C.M., Skoe, E., Russo, N.M., Dees, T. & Kraus, N. (2007) Musical experience shapes human brainstem encoding of linguistic pitch patterns. *Nature Neuroscience*, 10(4), pp.420-422.
- Zendel, B. & Alain, C. (2012) Musicians experience less age-related decline in central auditory processing. *Psychology and Aging*, 27(2), pp.410-417. doi:10.1037/a0024816.

THE USE OF JOINT ATTENTION IN THE NATURALISTIC SETTING IN CHILDREN WITH AUTISM SPECTRUM DISORDER

Cheryl Dalli, Joseph Agius

Department of Communication Therapy, Faculty of Health Sciences, University of Malta, Msida, Malta

Abstract. This study investigates the deficits in the quantity and quality of joint attention in children with Autism Spectrum Disorder (ASD). To obtain a holistic measure of joint attention, the following four aspects were considered: a) the quantity of Initiation Joint Attention (IJA) and Response Joint Attention (RJA), b) non-verbal behaviours which were atypically used during joint attention, c) the quality of joint attention and d) the association between quality and quantity of joint attention in children with ASD. These aspects were measured in three children with ASD and three typically-developing children (TDC). Measures were derived from 30-minute video recordings of a play session between each child and his/her caregiver and compared. This study established that there was a statistically significant difference in the quantity of joint attention in both IJA and RJA. The difference in the quality of joint attention was not statistically significant. However, when analysing children with ASD individually, a deficit in the quality of joint attention was identified in two of the three subjects. Compared to TDC, children with ASD engaged significantly less in IJA through manipulation of objects and eye-gaze and significantly more in IJA and RJA through challenging behaviour. In addition, there was no association between the deficits in quality and quantity of joint attention within individuals with ASD, as the three subjects portrayed diverse profiles. Children with ASD exhibited atypical joint attention skills when compared to the control group. Moreover, the frequency of initiations of joint attention bids was the most negatively affected aspect in children with ASD. Quality of joint attention is rarely researched and to the researchers' knowledge, no other study has measured both quality and quantity of joint attention in children with ASD.

Keywords: joint attention, Initiation Joint Attention, Autism Spectrum Disorder, Response Joint Attention

1 Introduction

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterised by an impairment in social communication

Correspondence to: Cheryl Dalli
(cheryldalli@gmail.com)

Received: 21.10.14 - Revised: 18.02.15 - Accepted: 22.02.15 -
Published: 25.05.15

© 2015 The authors

and social interaction, together with restricted and repetitive behaviours (American Psychiatric Association, 2013; Levy, Mandell & Schultz, 2009). Children with ASD show atypical development of joint attention skills (Buxbaum & Hof, 2013). Joint attention is a triadic exchange between two individuals with a common intent, upon the same object (Hafner & Kaplan, 2006). An agent is required to intentionally influence or track the other agent's attention for the process to be considered as joint attention (Hafner & Kaplan, 2006). Thus, simultaneous looking, which is when two agents look at an object together without a common intent, is not considered as joint attention.

A shift in attention is realised through the use of non-verbal behaviours (Hafner & Kaplan, 2006). These behaviours can be used to initiate or respond to attempts of social interaction with another agent (Block et al., 2007; Hogan, Mundy & Seibert, 1982). Thus, joint attention is categorised into two main classifications, Responding Joint Attention (RJA) and Initiating Joint Attention (IJA) (Boucher, 2007). IJA and RJA are diverse yet related processes (Mundy & Newell, 2007). RJA refers to the active following or response to the social partner's bid to an object or event. IJA is the ability to use these behaviours to seek the social partner's attention and direct it to an event, object or experience (Block et al., 2007; Bruinsma, Koegel & Koegel, 2004).

Of the two types of joint attention, IJA is especially associated with language and social development (Carr, Feeley & Jones, 2006). IJA supports language acquisition in instances where the caregiver takes the opportunity to name the object when the child spontaneously refers to it in the immediate environment (Mundy & Sigman, 2006; Tomasello, 1995). In a study by Gomes and Mundy (1998), a positive correlation between expressive language and IJA was identified. Mundy (1995) described IJA as the intrinsic motivation to share one's experience with another within the same context, thus stressing the importance of IJA in social development.

In the first years of life, the caregiver creates learning opportunities by specifying a particular object, or event, in the surrounding environment. The child is then required to differentiate between the object being referred to and other objects in the same context. This facilitates the process of mapping, whereby a new word is acquired and associated to the object it refers to (Mundy & Sigman, 2006). Thus, the child's RJA reflects that s/he is able, to some extent, to understand the initiator's intent. Through the adult's eye-gaze or gesture, the child is exposed to a learning experience. Thus, an impairment in RJA impedes this social or linguistic learning opportunity (Bauman et al., 2007).

Impairment in IJA and RJA affects a child's long-term social behaviour (Anderson et al., 2013). Since joint attention is a precursor of several other developmental abilities, exploring both the quality and quantity of joint attention behaviour in children with ASD can provide a better understanding of the deficits observed (Kasari & Lawton, 2012). To obtain a holistic measure of a child's abilities, quality of joint attention may be assessed in various contexts and with different social partners (Kasari & Lawton, 2012). In a longitudinal study, Kasari and Lawton (2012) explored the quality of joint attention in 52 pre-school children. These authors defined quality as "shared positive affect during joint attention" together with "shared positive affect and utterances during joint attention" (p.307). When positive emotions are expressed during social interaction, the child would be engaging in Shared Positive Affect (SPA). A study by Gernsbacher et al. (2008) compared measures of joint attention in a naturalistic setting and structured setting. The structured assessment was carried out using the Early Social Communication Scale (ESCS). A second session was then carried out to assess joint attention in a naturalistic administrator-child play session. Both sessions were video recorded. Video recorded sessions were then observed and decoded. Results demonstrated that both settings have potential to provide a realistic measure of joint attention skills in children with ASD (Gernsbacher et al., 2008). Thus, for the present study, a naturalistic setting was used to compare joint attention skills in children with ASD and in typically-developing children (TDC).

It was hypothesised that children with ASD would present with deficits in joint attention. The following research questions were investigated to better understand the use of joint attention in children with ASD: a) How is the quantity of RJA and IJA affected in children with ASD? b) Which types of non-verbal behaviours are atypically used in children with ASD? c) How is the quality of joint attention affected in children with ASD? d) What is the association between the quality and quantity of joint attention in children with ASD?

2 Methods

2.1 Participants

Three children with ASD and a control group of three TDC participated in the study. For each child with ASD, a TDC from the same school and having the same age and gender was recruited, to counteract the possibility that subject-related variables affected results. The latter is particularly likely when the number of study participants is limited (Cohen, Manion & Morrison, 2007). Research shows that joint attention continues to develop at least till the age of three years (Adamson et al., 2004; Block et al., 2007). Therefore, the age criterion for subject selection was set to 3;0-4;0 years. The means and standard deviations (SD) of the chronological ages (CA) of both groups of children are shown in Table 1. The subjects with ASD were recruited through the Speech-Language Department in Malta and had been diagnosed with autism by a psychologist independently from the study. The TDC were contacted through the schools the children with ASD attended and were matched for age and gender. Two pairs of male subjects and a pair of female subjects were recruited.

Table 1. Means and standard deviations (SD) of chronological age (years; months) for both subject groups.

Group	Sample Size	Mean	SD
TDC	3	3;07	0.04
ASD	3	3;08	0.03

2.2 Procedure

The children's joint attention behaviours were assessed in a naturalistic setting due to the latter's accessibility and effectiveness in measuring joint attention skills. The first author video recorded a 30-minute free play session between each child and his/her caregiver. Researchers have assessed joint attention during child-tester interaction, as well as child-caregiver interaction (Block et al., 2012; Gernsbacher et al., 2008). However, Mundy and Sigman (2006) argued that the relationship between the caregiver and the child can provide a more realistic measure of joint attention skills, as the child's performance would be to the best of the child's abilities. Thus, choosing the caregiver as the child's social partner improves the child's performance while maintaining a naturalistic setting. In this study, therefore, each child's social partner was the caregiver and playtime took place in the child's home, in order to ensure that the play setting was naturalistic. For every child, the mother volunteered to take part in the study as the caregiver.

A standard set of toys was used during playtime. This consisted of toy bricks, a puzzle, a book which encouraged touch, plain paper and crayons, a bubble bottle and a toy train. These toys are recommended by the Early Bird team of the National Autistic Society (Shields, 2011) to promote communication. Prior to the session, caregivers were instructed to present the child with one toy at a time. Toys were only replaced when the child requested a change or started to get distracted.

2.3 Data coding

The video recordings were viewed by the first author and coded for quantity and quality of joint attention. This section describes the preparation required for coding, as well as the coding process employed and the underlying rationale.

Measuring joint attention requires identification of the subject's intent. Thus, formal training is usually required to differentiate between simultaneous looking and joint attention. For example, in a study by Gernsbacher et al. (2008), coders were trained prior to scoring the outcomes of a structured assessment and a play sample. Since formal training or experienced raters were unavailable in the current study, a coding system was drawn up and practised on the video recording of a pilot play session (see Section 2.4). This recording was scored repeatedly by the first author until two consecutive identical scores were obtained. To enhance consistent scoring, definitions for each non-verbal behaviour for both IJA and RJA were compiled, together with a set of guidelines for scoring based upon instructions in the ESCS manual (Block et al., 2003). The adapted guidelines included instructions such as the following: if a joint attention behaviour is portrayed by more than one non-verbal behaviour, the first non-verbal behaviour performed by the child should be scored. In addition, more detailed definitions of the non-verbal joint attention behaviours listed in the Checklist of Non-verbal Communication (Agius, 2009) were drawn up, enabling identification of the different types of behaviours together with their frequencies. Among the non-verbal behaviours measured were manipulation of objects, eye-gaze and challenging behaviour.

During the main study, all recordings were viewed twice prior to scoring in order for the coder to become familiar with the session dynamics and gain insight on the subjects' intent during joint attention. Quantity of joint attention was coded in terms of frequency, following various studies and assessments (see Block et al., 2003; Gernsbacher et al., 2008). Coding of each video recorded session for the quantitative aspect took place in two stages. First, the joint attention non-verbal behaviour was identified. The recording was then either viewed again or paused to identify who commenced the bid, thus enabling classification of the behaviour as IJA or RJA and leading to a measure of the quantity of each. For coding purposes, quality of joint attention was considered in triadic exchanges in which child and caregiver showed a

common intent related to an object or event and portrayed positive emotion in the process. Non-verbal behaviours which demonstrated positive emotion were smiling and laughing. When these behaviours occurred without joint attention, they were not scored. Since quantity of joint attention was measured on the basis of the first nonverbal behaviour performed by the child, quality of joint attention could not be calculated through these scores. Quality of joint attention needed to be scored separately so that instances of joint attention which may not have initiated with a smile or a laugh, but included these behaviours at a point during the joint attention bid, could be identified. Quality is sometimes scored in terms of duration of these behaviours instead of frequency. For example, Kasari et al. (1990) and McMahon (2009) scored joint attention and SPA through a continuous coding system, using specialised software to code duration of joint attention. Such software programmes were not available during the study and are costly to acquire. For this reason, quality of joint attention was measured through frequency. Thus, similar to quantity of joint attention, quality of joint attention was scored in terms of frequency. Unlike quantity of joint attention, however, it was not scored as either IJA or RJA.

Measures of inter-rater reliability were not implemented. Due to limited human resources and time constraints, it was not possible to find an individual who would undergo training to distinguish joint attention from simultaneous looking.

2.4 Pilot study

Prior to recording the subjects' play sessions, a pilot study was carried out. A play session between a typically-developing child aged 4;01 years and his caregiver was video recorded and coded following viewing. This session gave insight on the method employed and enabled preparation for the subsequent recordings. The video recording also allowed the researcher to train in coding joint attention bids in a consistent manner.

2.5 Analysis

Statistical analysis involved the comparison of IJA and RJA between the two groups to identify differences in frequency of use of non-verbal behaviours and differences in frequency related to quality of joint attention.

The Independent Samples T-Test was used to compare quantity and quality of joint attention mean scores obtained by the children with ASD and the TDC. The null hypothesis specified that the mean scores were comparable between the two groups and would be accepted if the *p*-value exceeded the 0.05 level of significance. The alternative hypothesis specified that the mean scores differed significantly between the groups and would be accepted if the *p*-value was less than 0.05. A one-tailed test was employed throughout since prior knowledge from the research literature led to the expectation that TDC would score significantly higher for quantity and quality of joint attention skills than children with ASD. Each child with ASD was then paired with his/her typically-developing control and the raw scores of the resulting subject pairs, Pairs A, B and C, were analysed separately since statistical analysis of the

data for each pair was not viable.

2.6 Ethical considerations

Recruitment of subjects commenced once approval from the University of Malta's Research Ethics Committee had been granted. Privacy and confidentiality were maintained, as no information which could reveal the participants' identity was specified in the study. All of the caregivers signed consent forms before data collection was initiated. The findings and results reported are true.

3 Results

Differences in quantity of joint attention across the two groups are reported first. Quantity of joint attention is then examined amongst pairs. The same approach is used to explore differences in quality of joint attention in TDC and children with ASD.

For quantity of joint attention, Table 2 shows the descriptive statistics for IJA obtained for both subject groups. The mean IJA score for TDC exceeded the mean IJA for children with ASD by more than 30 scale points. This difference was found to be statistically significant ($t(4) = 4.65, p = 0.005, (1\text{-tailed})$). Thus, the alternative hypothesis was satisfied.

Table 2. Means, standard deviations (SD) and standard error means for quantity of joint attention (IJA) in TDC and children with ASD.

Group	Sample Size	Mean	SD	Std. Error Mean
TDC	3	56.00	2.00	1.16
ASD	3	23.00	12.12	7.00

Descriptive statistics obtained for quantity of joint attention (RJA) are presented in Table 3. The mean RJA score for TDC exceeded that obtained for children with ASD by more than 20 scale points. This difference was found to be statistically significant ($t(4) = 2.30, p = 0.041 (1\text{-tailed})$), satisfying the alternative hypothesis.

Table 3. Means, standard deviations (SD) and standard error means for quantity of joint attention (RJA) in TDC and children with ASD.

Group	Sample Size	Mean	SD	Std. Error Mean
TDC	3	76.33	10.07	5.81
ASD	3	54.00	13.45	7.77

Mean scores of IJA through manipulation of objects and through eye-gaze in TDC exceeded that of children with ASD, with these differences resulting as statistically significant (see Table 4).

Table 4. Means, standard deviations (SD), standard error means and *p*-values for quantity of joint attention (IJA bids through manipulation of objects and eye-gaze) in TDC and children with ASD.

Non-Verbal Behaviour	Group	Sample Size	Mean	SD	Std. Error Mean	<i>p</i> -value
IJA through manipulation of objects	TDC	3	30.00	7.55	4.36	0.041
	ASD	3	7.67	6.03	3.48	
IJA through eye-gaze	TDC	3	2.00	0.00	0.00	0.004
	ASD	3	0.33	0.57	0.33	

Table 5. Means, standard deviations (SD), standard error means and *p*-values for quantity of joint attention (IJA and RJA bids through challenging behaviour) in TDC and children with ASD.

Non-Verbal Behaviour	Group	Sample Size	Mean	SD	Std. Error Mean	<i>p</i> -value
IJA through challenging behaviour	TDC	3	0.00	0.00	0.00	0.029
	ASD	3	2.33	1.53	0.88	
RJA through challenging behaviour	TDC	3	0.00	0.00	0.00	0.034
	ASD	3	1.67	1.16	0.67	

The mean scores of IJA and RJA through Challenging Behaviour in children with ASD exceeded those of TDC. In both IJA and RJA, this difference was found to be statistically significant (see Table 5), satisfying the alternative hypothesis.

With regards to quality of joint attention (SPA during joint attention), the mean score for TDC exceeded the mean score for children with ASD by more than 25 scale points (refer to Table 6 for the relevant descriptive statistics). However, this difference was not statistically significant ($t(4) = 1.55, p = 0.099$ (1-tailed)), disproving the alternative hypothesis.

Table 6. Means, standard deviations (SD) and standard error means for quality of joint attention (SPA during joint attention) in TDC and children with ASD.

Group	Sample Size	Mean	SD	Std. Error Mean
TDC	3	39.67	17.67	10.20
ASD	3	14.33	22.23	12.84

4 Discussion

4.1 Quantity of joint attention

Children with ASD scored significantly less in frequency of RJA than TDC. The difference in IJA between the two groups was also statistically significant. Mundy and Newell (2007) proposed that these differences in RJA and IJA can be observed throughout the child's development.

Since joint attention skills develop by the age of three (Block et al., 2007), it can be hypothesised that any identified deficits in RJA and IJA will persist at later stages of development. Therefore, at a mean CA of 3;08 years, the group of children with ASD observed in this study would be inclined to engage in fewer instances of RJA and IJA.

When comparing quality of joint attention (SPA during joint attention) in pairs, the score for the child with ASD in Pair A exceeded the score of the typically-developing control by more than 10 scale points. However, in Pairs B and C, the TDC's scores exceeded the scores of the children with ASD by 30 and 60 scale points respectively. Table 7 lists the scores obtained.

Table 7. Means, standard deviations (SD) and standard error means for quality of joint attention (SPA during Joint Attention) in TDC and children with ASD.

Pair	Child	SPA score
A	TDC	28
	ASD	40
B	TDC	31
	ASD	2
C	TDC	60
	ASD	1

TDC showed fewer instances of RJA than IJA. However, the discrepancy between the two processes of joint attention was more pronounced in children with ASD. When comparing RJA to IJA, it is evident that even though both processes were significantly reduced in children with ASD, deficits in IJA were more severe. This discrepancy between the two processes is noticeable through p -values; with a p -value of 0.041 for RJA and 0.005 for IJA, the latter is decidedly more impaired. This result adheres to Mundy and Newell's (2007) statement that children with ASD engage more in RJA than in IJA, with deficits in

IJA being more prominent and persistent. Since both processes were found to be impaired but to a different degree, this result corresponds with Mundy and Newell's (2007) finding that IJA and RJA are diverse yet related processes.

4.1.1 Pair A

RJA scores in Pair A were almost equal. Such a score could have occurred as a result of two possibilities. The child with ASD may have had minimal or even no impairment in RJA. The other possibility is that the child with ASD had a deficit in RJA which was masked or diminished by the mother's interactive and positively reinforcing method of play.

The frequency score for IJA was marginally more than half of that for RJA in the child with ASD. The discrepancy between the two processes was not as extensive in the typically-developing control. Such a result affirms the severity of impairment in IJA; even though RJA may only be minimally affected, IJA is still severely impaired.

4.1.2 Pair B

RJA scores varied in the typically-developing child and the child with ASD. However, the IJA scores were even more distinct. The child with ASD engaged nearly half as much in IJA as in RJA. This degree of impairment in IJA is congruent with the degree of impairment in the child with ASD in Pair A. RJA was more impaired in the child with ASD in Pair B than in Pair A.

4.1.3 Pair C

RJA and IJA scores were acutely reduced in the child with ASD. RJA in the typically-developing child was twice as much, while IJA scores were six times as much as the control's. IJA is a voluntary goal-oriented system which is reinforced and/or modified by the responder (Mundy & Newell, 2007). Through the video recording, it was noted that the interaction between the mother and child with ASD in Pair C was not reinforcing, thus influencing the child's performance. It can be argued that such a mode of interaction was adopted as a result of the child's social communication and social interaction difficulties. This chain of events was described by Abbott et al. (2004) as a 'negative feedback loop' resulting from an impairment in joint attention.

On the other hand, the typically-developing child in Pair C obtained a particularly high score in RJA, due to the interactive mode of play adopted by the child's parent. The interaction approach used demanded several RJA bids during playtime. This increase in RJA emphasised the differences in RJA between the two subjects within Pair C. Nevertheless, the child with ASD in Pair C did obtain the lowest scores in both IJA and RJA among all the subjects.

Even though all subjects with ASD obtained lower scores in both RJA and IJA than their typically-developing controls, the degree of impairment in the quantity of both RJA and IJA varied from one subject to another.

4.1.4 Non-verbal behaviours

The non-verbal behaviours which were most frequently used were identified through the adaptation of the Checklist of Non-verbal Communication (Agius, 2009). Statistically significant differences between the two groups were observed in IJA through manipulation of objects, IJA through eye-gaze and IJA and RJA through challenging behaviour.

In the TDC, joint attention was most frequently initiated through manipulation of objects. Since individuals with ASD have reduced quantity of joint attention, it was expected that the most frequently used behaviour in TDC would present with the largest discrepancy in use in relation to children with ASD.

When it comes to IJA through eye-gaze, this non-verbal behaviour was seldom used in the TDC and the children with ASD. Still, the resulting difference between the two groups was statis-

tically significant. In order to be scored, such a behaviour required verbal expression to attract the social partner's attention and transfer it to the object or event intended. Verbal abilities in the children with ASD were not at par with verbal abilities in the TDC. This factor may therefore reflect the use of verbal language during IJA through eye-gaze. Verbal skills were not assessed in the TDC and the children with ASD. Thus, claims made regarding their verbal abilities are based upon observations.

Challenging behaviour was only observed during interaction between children with ASD and their caregivers. Thus, the children with ASD engaged more in IJA and RJA through challenging behaviour than did the TDC. In addition, the use of negative expressions can impair social interaction between the child and communicative partner, resulting in a 'negative feedback loop' (McMahon, 2009).

4.2 Quality of joint attention

Quality of joint attention was assessed through the frequency of SPA during joint attention. The difference in mean scores for the two groups was not statistically significant. This result may have occurred due to a limited sample size. Another possibility is that SPA was measured according to frequency and not duration. Thus, a child who maintained SPA for a prolonged period of time during a single bid was scored the same as a child who momentarily used SPA during a bid.

4.2.1 Pair A

The child with ASD exceeded the typically-developing child in frequency of SPA. Yet, the typically-developing control did not have a low SPA score when compared to the TDC of Pairs B and C. The interaction between the caregiver and the child with ASD involved continuous positive reinforcement. This approach may have influenced the quality of joint attention.

4.2.2 Pair B

The difference in quality of joint attention between the two subjects was clearly visible within Pair B. The child with ASD engaged in SPA during joint attention in two instances, emphasising the deficit in quality of joint attention within the pair.

4.2.3 Pair C

The typically-developing control obtained a score of 60 joint attention bids which involved SPA. Such a high score stands to reason since this child engaged in a large number of joint attention bids, especially RJA. However, the child with ASD only engaged once in SPA during joint attention. This subject was also the one to engage least in joint attention bids. In addition, the interaction between mother and child did not include positive reinforcement, which fact could have influenced the result obtained.

Among the three subjects with ASD, two showed severely impaired SPA during joint attention. In fact, these subjects engaged more in either neutral or negative behaviours. Previous research identifies shared negative affect as not being a reliable determinant for identifying differences in joint attention between TDC and children with ASD (Kasari et al., 1990; McMahon, 2009). Thus, by elimination, children with ASD who seldom engage in SPA often engage in neutral behaviour. McMahon (2009) stated that both negative and neutral behaviours act as a 'negative feedback loop' in the interaction between communicative partner and child. Parents of children with ASD whose SPA during joint attention was low, engaged in fewer instances of positive reinforcement. The process of reinforcement was not measured, but was observed during the viewing of the recordings.

4.3 The association between the quality and quantity of joint attention in children with Autism Spectrum Disorder

No association between the two aspects of joint attention was found. The two subjects with ASD from Pairs A and B engaged in similar quantities of IJA and RJA. However, their scores in SPA during joint attention were decidedly diverse; 40 and 2 respectively. In addition, children with ASD in Pairs B and C obtained similar scores in SPA during joint attention; 2 and 1 respectively. However, their scores in quantity of joint attention varied.

5 Conclusion

The quantity of both IJA and RJA was found to be impaired in the subjects with ASD, confirming current theoretical knowledge. In addition, deficits in IJA were more profound than deficits in RJA. The quality of joint attention was not affected in children with ASD. However, when evaluating the children's performance individually, two of the three children with ASD showed a deficit in quality of joint attention. The other child with ASD did not show such an impairment. The quality of joint attention in children with ASD is seldom researched and evaluated. Thus, further research is required to determine accurate profiles of joint attention in children with ASD, particularly in quality of joint attention. In order to establish a holistic measure of the child's abilities, the quality of joint attention may be assessed in various contexts and with different social partners. In addition, identifying correlations between the two aspects of joint attention is also beneficial to understand the nature of such a skill, its effect on children with ASD and even on their interactive partners. Furthermore, future research should investigate the influence of the caregiver's interaction with the child on the child's joint attention skills, particularly in relation to the 'negative feedback loop'. Intervention can improve both quality and quantity of joint attention. However, accurately identifying such aspects of joint attention paves the way to developing an effective, evidence-based intervention programme which targets both quantity and quality of joint attention.

6 Funding

This research has received no specific grant from any funding agency in the public, commercial or non-profit sectors.

7 Conflicts of interest

The authors report no conflicts of interest.

References

- Abbott, R., Dawson, G., Estes, A., Liaw, J., Munson, J., Osterling, J. & Toth, K. (2004) Early social attention impairments in autism: social orienting, joint attention, and attention to distress. *Developmental Psychology*, 40(2), pp.271-283.
- Adamson, L.B., Bakeman, R. & Deckner, D.F. (2004) The development of symbol-infused joint engagement. *Child Development*, 75(4), pp.1171-1187.
- Agius, K. (2009) *Nonverbal Children with Autistic Spectrum Disorders: How do they communicate?* Unpublished M.Ed. dissertation. Birmingham: University of Birmingham.
- American Psychiatric Association (2013) *Diagnostic and Statistical Manual for Mental Disorders (5th ed.)*. Arlington: American Psychiatric Publishing.
- Anderson, D., Floody, H., Lord, C. & Pickles, A. (2013) *Social En-*

- agement in *Very Young Children with Autism: Differences across contexts*. Tampa, FL: The Society for Research in Child Development.
- Bauman, M., Finelli, J., Garrett-Mayer, E., Landa, R., Marvin, A. & Sullivan, M. (2007) Response to joint attention in toddlers at risk for autism spectrum disorder: a prospective study. *Journal of Autism and Developmental Disorders*, 37(1), pp.37-48.
- Block, J.J., Delgado, C.E., Hobson, J.A., Mundy, P., Parlade, M.V., Pomares, Y.B. & Van Hecke, A.V. (2012) Infant responding to joint attention, executive processes, and self-regulation in preschool children. *Infant Behavior and Development*, 35(2), pp.303-311.
- Block, J., Delgado, C., Hogan, A., Mundy, P., Seibert, J. & Venezia, M. (2003) *Early Social Communication Scale*. Miami: University of Miami.
- Block, J., Delgado C., Mundy, P., Pomares, Y., Van Hecke, A.V. & Parlade, M.V. (2007) Individual differences and the development of joint attention in infancy. *Child Development*, 78(3), pp.938-954.
- Boucher, S. M. (2007) *Joint Attention, Imitation, and Repetitive Behaviors as Predictors of Autism and Expressive Language Ability in Early Childhood*. Michigan: ProQuest Information and Learning Company.
- Bruinsma, Y., Koegel, L.K. & Koegel, R.L. (2004) Joint attention and children with autism: a review of the literature. *Mental Retardation and Developmental Disabilities Research Reviews*, 10(3), pp.169-175.
- Buxbaum, J.D. & Hof, P.R. (Eds) (2013) *The Neuroscience of Autism Spectrum Disorders*. Oxford: Elsevier.
- Carr, E. G., Feeley, K. M. & Jones, E. A. (2006) Multiple effects of joint attention intervention for children with autism. *Behavior Modification*, 30(6), pp.782-834.
- Cohen, L., Manion, L. & Morrison, K. (2007) *Research Methods in Education (6th ed.)* London: Routledge.
- Gernsbacher, M.A., McDuffie, A.S., Roos, E.M. & Ellis Weismer, S. (2008) A comparison of contexts for assessing joint attention in toddlers on the autism spectrum. *Autism*, 16(3), pp.275-291.
- Gomes, A. & Mundy, P. (1998) Individual differences in joint attention skill development in the second year. *Infant Behavior and Development*, 12(3), pp.469-482.
- Hafner, V. & Kaplan, F. (2006) The challenges of joint attention. *Interaction Studies*, 7(2), pp.135-169.
- Hogan, A. E., Mundy, P. C. & Seibert, J. M. (1982) Assessing interactional competencies: the Early Social Communication Scales. *Infant Mental Health Journal*, 3(4), pp.244-258.
- Kasari, C. & Lawton, K. (2012) Brief report: longitudinal improvements in the quality of joint attention in preschool children with autism. *Journal of Autism and Developmental Disorders*, 42(2), pp.307-312.
- Kasari, C., Mundy, P., Sigman, M. & Yirmiya, N. (1990) Affective sharing in the context of joint attention interactions of normal, autistic, and mentally retarded children. *Journal of Autism and Developmental Disorders*, 20(1), pp.87-100.
- Levy, S.E., Mandell, D.S. & Schultz, R.T. (2009) Autism. *The Lancet*, 374(9701), pp.1627-1638.
- McMahon, C. R. (2009) *Shared positive affect: an early behavioral risk marker for autism spectrum disorders*. Unpublished Ph.D. dissertation. United States: Vanderbilt University.
- Mundy, P. (1995) Joint attention and social-emotional approach in children with autism. *Development and Psychopathology*, 7(1), pp. 63-82.
- Mundy, P. & Newell, L. (2007) Attention, joint attention, and social cognition. *Current Directions in Psychological Science*, 16(5), 269-274.
- Mundy, P. & Sigman, M. (2006) Joint attention, social competence, and developmental psychopathology. In D. Cicchetti & D.J. Cohen (Eds) *Developmental Psychopathology, Theory and Method (2nd ed.)* (pp. 293-332). New Jersey: John Wiley & Sons.
- Shields, J. (2011) *Toys and leisure activities*. [Online] Available from: <http://www.autism.org.uk/living-with-autism/at-home/toys-and-leisure-activities.aspx>. [Accessed: 18th September 2013].
- Tomasello, M. (1995) Joint attention as social cognition. In P.J. Dunham & C. Moore (Eds) *Joint Attention, its Origins and Role in Development*(pp.103-113). Hillsdale, NJ: Lawrence Erlbaum.

THE CURRENT SITUATION FOR THE WATER SOURCES IN THE MALTESE ISLANDS

David Spiteri¹, Chris Scerri², Vasilis Valdramidis¹

¹Department of Food Studies and Environmental Health, Faculty of Health Sciences, University of Malta, Msida, Malta

²Department of Physiology and Biochemistry, Faculty of Medicine and Surgery, University of Malta, Msida, Malta

Abstract. This commentary addresses issues related to the scarcity of water in the Maltese Islands and its main causes. Some basic metrics related to the abstraction of freshwater, contamination of groundwater by nitrate and the limitations and challenges of the water sources in the Maltese Islands are highlighted. Hereafter, the relation between water scarcity, rainfall and population density, as well as the resultant effects on the sustainability of the freshwater sources of the Maltese Islands are presented. The current focus is on the production of good quality water based on a number of Reverse Osmosis (RO) plants that are found around the Maltese Islands. The significant energy requirements of this technology are compared with those for groundwater and wastewater treatment production. Current practices in the Maltese Islands regarding the treatment and use of sewage effluent by Sewage Treatment Plants (STPs) are described. The use of treated sewage effluent as an alternative source of water to RO water and of groundwater for second class uses is discussed. This paper concludes that the technology needed to employ treated effluents for unrestricted agricultural use and also for aquifer recharge is now in existence.

Keywords: water, reverse osmosis, sewage effluent, aquifer

1 Water Sources in the Maltese Islands

Due to the geographic and climatic conditions of the Maltese Islands, freshwater is a very scarce resource. It is reported that 70% of the country is facing water stress due to both water scarcity and deterioration (Eurostat, 2014). Malta has no surface water that can be commercially exploited (Mangion, Micallef & Attard, 2005). In fact, almost all of Malta's natural freshwater reserves are stored in groundwater aquifers (Eurostat, 2014). These aquifers are only replenished when rainwater is absorbed into the ground and slowly percolates into them, making them a finite resource. On average, it is reported that only about 23 million m³ of groundwater are available for human use through extraction (Malta Busi-

ness Bureau, 2014).

According to the European Union (EU)'s Statistics Office, Malta has only 188 m³ of freshwater per inhabitant, which ranks among the lowest levels in Europe, placing Malta in the top ten water scarce countries (Eurostat, 2014). Low annual rainfall of about 553.1 mm (National Statistics Office, Malta (NSO), 2013), a high population density (approximately 1322.2 per km² in 2011 (UN Data, 2014)), together with an intensive tourism sector, cause a huge strain on the freshwater sources of the Maltese Islands. It is estimated that a total of 34 million m³ of freshwater are extracted annually, which is 11 million m³ more than the local aquifers can handle (Malta Resources Authority, 2004; NSO, 2013, 2014). Thus, due to lack of enforcement, the authorities have failed to successfully control water uptake from illegal boreholes, severely straining the availability of groundwater for the present and future generations.

Extracting more than the aquifer can handle will displace freshwater with seawater, bringing about an increase in the salinity of the groundwater. Furthermore, overuse of fertilisers has led to excessive nitrates coming into contact with Malta's groundwater. It has been estimated that the average nitrogen content per hectare is between 151.7kgN/ha and 227.8kgN/ha per annum, despite the Nitrate Directive of the EU stipulating the value of 170kgN/ha (Malta Resources Authority, 2004). This has resulted in 90% of all the extracted groundwater not meeting the EU standards for safe drinking, due to the exceedance of nitrate levels as stipulated in the Drinking Water Directive (Malta Resources Authority, 2004; Malta Environment and Planning Authority, 2014). There is a total of 16 groundwater sources in the Maltese Islands, with 15 of these listed as being at risk for contamination (Malta Environment and Planning Authority, 2014) (see Figure 1).

2 Production of Quality Water

In order to produce good quality water while also meeting the required demands, a number of Reverse Osmosis (RO) plants have been constructed across the Maltese Islands. In Malta, these RO plants are located in Ċirkewwa, Lapsi and Pembroke. A Groundwater Polishing Plant is found in Ta' Ċenċ, Gozo. RO is a process through which filtered seawater is forced under very high pressure through permeable membranes. These membranes are able to filter out most molecules, including salts, ions and bacteria, purifying the source to potable standards. Unfortunately, this process is energy-intensive. Up to 4.6 kWh of electricity are consumed for every cubic metre of water produced, resulting in approximately 4% of all of the Maltese Islands' electricity going towards the generation of freshwater from seawater (NSO, 2014). This is significantly lower than the specific energy consumption

Correspondence to: David Spiteri
(davids@vol.net.mt)

Received: 02.09.14 - Revised: 16.11.14 - Accepted: 02.03.15 -
Published: 25.05.15

© 2015 The authors

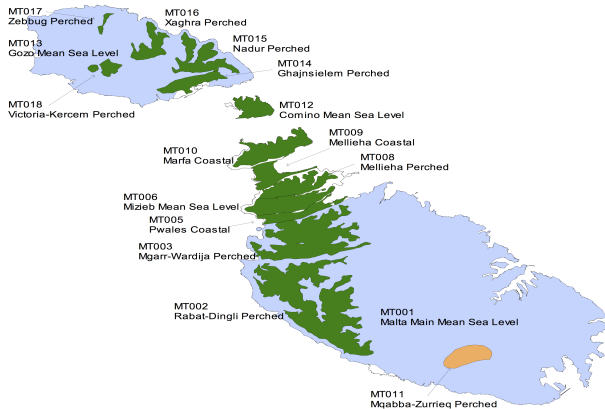


Figure 1: Groundwater bodies found in the Maltese Islands (Copyright ©2014 Malta Resources Authority; reproduced with permission).

in the mid-1990s, which was approximately 7.0 kWh/m^3 , due to the greater amount of water produced to meet the demand. In comparison, the specific energy consumption for groundwater is 0.8 kWh/m^3 . For the production of treated effluent from municipal wastewater, the Sant'Antnin treatment plant in Marsascala, Malta, uses 1.3 kWh/m^3 (NSO, 2014). Figure 2 shows the electricity consumption of water production sources, with a lower trend emerging as investment in energy-efficient technologies, particularly in RO, proved successful.

Therefore, it can be concluded that although RO plants are indispensable in meeting the potable water demand of the country, they cause a huge strain on the Maltese economy, while also increasing the national carbon footprint. Thus it is important to investigate the possibility of meeting part of the country's water demand through less energy-intensive alternatives.

3 Water Management in Malta

Between 2004 and 2013, 55.7% of all water utilised in Malta was produced by RO plants, while the other 44.3% came from groundwater sources (NSO, 2014). Over the years, governments have been trying to investigate trends in water consumption. In order to further illustrate water use in Malta, a report published by the Malta Resources Authority in 2004 indicated that the annual billed consumption was at 18 million m^3 of water. However, the Water Services Corporation reported that the annual consumption exceeded 38 million m^3 of water annually (Malta Resources Authority, 2004). This shows a huge discrepancy of 20 million m^3 . There is currently no evidence on how this amount of water is utilised.

It is important for farmers to have a good quality alternative to groundwater sources. The reuse of waste-water can be a good solution, as evidenced by the Moriso Project being implemented and researched by the Water Services Corporation (2013). Since 2004, the Water Services Corporation also became responsible for the collection, disposal and treatment of wastewater. Originally, only the Sant'Antnin plant existed. This is a treatment plant found in Marsascala, in the south of Malta, which has been in operation for the last 30 years. In 2009, it was reported to have treated about 2 million m^3 of sewage, with half as much of the treated municipal waste going to agriculture and industry (Water Services Corporation, 2009). Approximately 75% of the treated water was used to irrigate 240 ha of land, while the remaining water was sold off to industry as second class water (Malta Resources

Authority, 2004). During the past 10 years, the Sant'Antnin plant produced on average 1.3 million m^3 of irrigation effluent per year, that was used both in industry and agriculture, and 0.7 million m^3 of unused irrigation effluent that was discharged into the sea (NSO, 2014). Unfortunately, a gradual decline in the demand for irrigation water produced by this plant was reported (NSO, 2014). This was probably due in part to a deterioration in the quality of the effluent because of increasing salinity, resulting from the lack of salinity reduction processes at the plant (Gauci, 1993; Mangion, 2000).

The urban wastewater directive, 91/271/EEC, constrained EU countries to invest in the construction of several Sewage Treatment Plants (STPs) for treating sewage effluent before it is discharged into the sea. Nowadays, industrial scientists have been investigating ways of solving water shortage by safely utilising treated effluent as second class water. Currently, a total of four STPs are found in the Maltese Islands: Gozo STP, North STP, Ta' Barkat STP in the south of Malta and Sant'Antnin STP, the latter meant to be decommissioned in due course. All of these STPs implement tertiary treatment of wastewater. Sant'Antnin STP, North STP and Gozo STP employ sand filtration followed by chlorination, while Ta' Barkat, the newest STP, has facilities for sand filtration and UV treatment (United Nations Environment Programme, 2008). It is understood that all treated effluent produced by the North, Gozo and Ta' Barkat treatment plants is released into the marine environment, and is not being used for agricultural or industrial purposes.

4 Operation of Sewage Treatment Plants (STPs) in the Maltese Islands

As explained above, a number of STPs are found around the Maltese Islands. The Gozo STP, found in the limits of Mgarr ix-Xini, was built in 2007. During 2009, it treated approximately 4,000 m^3 of sewage per day. The North STP, located in the limits of Mellieħa, started operations in 2008. It treats up to 8,200 m^3 of raw sewage a day, before this is released into the sea through the marine sewage outfall. The Ta' Barkat STP is capable of treating up to 60,000 m^3 per day and treats around 80% of all the sewage produced in the Maltese Islands (United Nations Environment Programme, 2008; Water Services Corporation, 2009). This STP was the last to be built and utilises three main processes for water treatment, as described below.

4.1 Processing by a Sewage Treatment Plant (STP)

Mechanical filtration is important to remove all the solid waste that may be found in the crude sewage. The heavier and bulkier solid waste is removed by mechanical grits, which resemble cages, in order for the solids to be removed and processed separately. The remaining fine particles, such as sand, are passed on to a secondary process, where a rotating machine removes the remainder of the particles. This is the part where the sewage is treated chemically in order to further bind any solid particles still present. The water is first treated with pH-stabilising chemicals in order to allow the sewage to become stable at around 7.5 to 8.5, in order to prevent the re-dissolving of certain precipitates, while also precipitating hydroxides of dissolved heavy metals. Next, ferric or aluminium (III) salts, followed by other synthetic polymer coagulants, are added in order to bind to the solid particles, which thus become heavier and sink to the bottom. This occurs in settling tanks, with the remaining solid material then treated as sludge. The sludge is treated separately and is used to produce 1 MW of power, which is in turn used to run the STP. The remaining water is passed on for biological treatment. As part of the secondary treatment, water

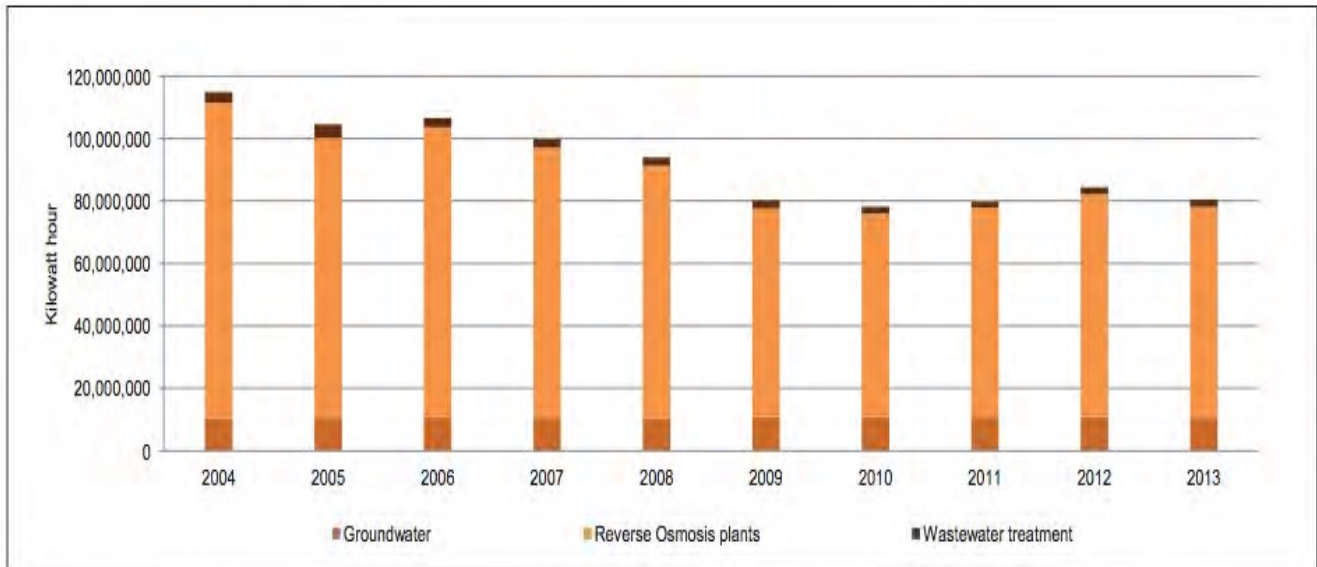


Figure 2: Electricity consumption of water production sources (Copyright ©2014 National Statistics Office, Malta (NSO); reproduced with permission).

is allowed to settle in anaerobic conditions, where anaerobes act upon the nutrients found in the water and remove them by means of denitrification. Nitrogen gas is removed and then released in the environment. Following this process, water is passed into other tanks where blowers 'foam' it up, allowing aerobes to continue removing any organic waste. The STP then releases the treated effluent into the marine environment by means of underwater pipes beneath the thermocline.

5 Conclusions

The Maltese Islands have always suffered from water scarcity and particularly during the last century, when the increasing population, irrigated agriculture and tourism placed enormous demands on the country's limited resources. Although public water agencies have invested heavily in improving water production and distribution, exploitation of groundwater resources still reaches unprecedented levels. To date, treated sewage effluent has been under-utilised, despite the fact that the country has invested in treatment plants to treat all sewage. Technologies to make treated effluent useable are currently available on the market and may be considered as a means to produce polished effluent for agricultural use and for increasing recharge of the aquifers.

6 Funding

This work was supported by a Malta Government Scholarship Scheme grant awarded to David Spiteri and by the University of Malta Research Fund (Grant DES/192/2014/46).

7 Conflicts of Interest

The authors report no conflicts of interest.

References

- Eurostat (2014) *Water statistics - statistics explained*. [Online] Available from: http://ec.europa.eu/eurostat/statistics-explained/index.php/Water_statistics. [Accessed 13th July 2014].
- Gauci, V. (1993) Supply of irrigation water in a semi-arid area. In S. Busuttil, F. Lerin & L. Mizzi (Eds) *Malta: Food, agriculture, fisheries and the environment* (pp. 83-91). Montpellier: CIHEAM (Options Méditerranéennes: Série B; Etudes et Recherches, n. 7).
- Malta Business Bureau. *Water scarcity* [Online] Available from: <http://www.investinginwater.org/Water+Scarcity/Water+Scarcity/589> [Accessed 13th July 2014].
- Malta Environment and Planning Authority (2014) *Waters in Maltese Islands*. [Online] Available from: <http://www.mepa.org.mt/topics-water-islands> [Accessed 13th July 2014].
- Malta Resources Authority (2004) *Economic characterization of the Maltese water catchment district*. [Online] Available from: http://mra.org.mt/wp-content/uploads/2012/08/6.economic_charcaterisation_FULL.pdf [Accessed 13th July 2014].
- Malta Resources Authority (2014) *Groundwater bodies* [Online] Available from: <http://mra.org.mt/wp-content/uploads/2012/08/wfd-Groundwater-Bodies.pdf> [Accessed 13th July 2014].
- Mangion, M. (2000) Utilization of treated urban waste waters for irrigation purposes in the south of Malta. In N. Lamadadena (Ed.) *Proceedings of the Annual Meeting of the Mediterranean Network on Collective Irrigation Systems (CIS-Net)* (pp.45-49). Bari: CIHEAM (Options Méditerranéennes: Série B; Etudes et Recherches, n. 31)
- Mangion, J., Micallef, P. & Attard, G. (2005) Treated sewage effluent - an alternative water supply for the Maltese islands. In A. Hamdy (Ed.) *Non-Conventional Water Use: WASAMED project* [Online] Available from: <http://ressources.ciheam.org/om/pdf/b53/00800772.pdf> [Accessed 9th June 2013].

- Mangion, J., Micallef, P. & Attard, G. (2005) Treated sewage effluent - an alternative water supply for the Maltese islands. In A. Hamdy (Ed.) *Non-Conventional Water Use: WASAMED project* [Online] Available from: <http://ressources.ciheam.org/om/pdf/b53/00800772.pdf> [Accessed 9th June 2013].
- National Statistics Office, Malta (NSO) (2013) *World Water Day 2013: International Year of Water Cooperation*. NSO 056/2013.
- National Statistics Office, Malta (NSO) (2014) *World Water Day 2014: Water and Energy*. NSO 054/2014.
- United Nations Environment Programme (2008) Municipal wastewater treatment plants in Mediterranean coastal cities: inventory of treatment plants in cities of between 2,000 and 10,000 inhabitants. *Mediterranean Action Plan for the Barcelona Convention Technical Reports*, No. 169.
- UN Data (2014) *Country profile - Malta*. [Online] Available from: <http://data.un.org/CountryProfile.aspx?crName=MALTA> [Accessed 20th July 2014].
- Water Services Corporation (2009) *Water operations*. [Online] Available from: http://www.wsc.com.mt/sites/default/files/annual-report-09_-_wastewater_operations_unit.pdf [Accessed 15th November 2014].
- Water Services Corporation (2013) *Moriso Project Inauguration* [Online] Available from: <http://www.wsc.com.mt/content/moriso-project-inauguration> [Accessed 15th November 2014].

COMMUNITY AWARENESS AND PERCEPTION TOWARDS RODENT CONTROL: IMPLICATIONS FOR PREVENTION AND CONTROL OF LASSA FEVER IN URBAN SLUMS OF SOUTHWESTERN NIGERIA

Adebimpe Wasiu Olalekan

Department of Community Medicine, College of Health Sciences, Osun State University, Osogbo, Nigeria

Abstract. Domestic rodents have been implicated in the community transmission of Lassa fever (LF). Community awareness of vector control could lead towards control of LF, most especially in densely populated and overcrowded slums. The aim of the study was to assess knowledge and attitude towards rodent control in relation to LF in Southwestern Nigeria. This descriptive cross-sectional study of LF and rodent control was carried out among 500 community members selected using a multistage sampling method. The research instrument was a self-administered semi-structured pre-tested questionnaire. Data were analysed using SPSS software. 101 participants (20.2%) had heard about LF. Mean composite scores showed 19.4%, 14.1%, 17.0% and 13.9% of respondents to have good knowledge of occurrence, causes, disease transmission, as well as prevention and control of LF respectively. 215 participants (43.0%) lived in overcrowded rooms and only 36 (9.1%) claimed to never have seen a rat in their houses. 206 respondents (41.2%) said they often saw rats crossing between houses. Some recommendations for rodent control were suggested. It was concluded that poor awareness and knowledge of LF, together with poor housing facilities, characterised the communities studied. There is a need for relevant stakeholders to ensure better community health education and improved housing conditions in Southwestern Nigeria, with an emphasis on slum areas.

Keywords: Lassa fever, slum communities, rodent control, poor housing

1 Introduction

The environment in which a man lives could influence his development and health. Among the common environmental determinants of health, poor hygiene and poor housing are pressing problems facing the urban cities (Karija, Shihua & Lukaw, 2013). The resulting problem of unplanned urbanisation and subsequent un-

precedented population growth become more relevant to developing countries where policy for physical development and control merely exist on paper, without being implemented (Hala, 2013). Nigeria, with a population of about 140 million, an annual urban growth of 3.8% and a poor solid waste management system, could inevitably witness an upsurge in her number of urban slums (Omole, 2003). By the year 2025, about 61% of the world's population will be living in urban areas, especially in developing countries. The urban population will double from 2.4 billion in 1995 to an estimated 5 billion by 2025. In addition, 72% of the population in sub-Saharan Africa, or 166 million people, live in slums or informal settlements. These settlements are characterised by housing of poor quality, thus putting the lives and health of the residents in continuous dangers (United Nations, 2010).

Improper waste disposal results in breeding places for vectors of disease, while poor levels of housing offer easy access to rodents, which is more common in urban areas. These problems result in a significant spread of communicable diseases or new syndromes, thus adding to the local disease burden (United Nations Human Settlements Programme (UN-HABITAT), 2003; Rodhain 1996). Lassa fever (LF) transmission can occur by direct contact or with the environmental contact of an arthropod vector (UN-Habitat, 2003).

LF is caused by a single-stranded RNA virus (Lopez & Mathers, 2006; Lopez et al., 2001). The main feature of the fatal illness is impaired or delayed cellular immunity leading to fulminant viraemia (Daniel et al., 2013). The natural hosts for the virus are multimammate rats (*Mastomys natalensis*), which breed frequently and are distributed widely throughout West, Central and East Africa (Lopez & Mathers, 2006).

In slum communities where poverty prevails and standards of living are low, overcrowding subsists and rodents often move across from house to house, spreading the virus. Many studies have reported poor community awareness and knowledge of LF (Richmond & Bagloe, 2003; Tobin et al., 2014). Thus, there is a need to improve community attitudes to preventive measures in relation to rodent control in households and communities. This could assist in ensuring better prevention and control of LF through environmental means. The aim of this study is to assess knowledge and attitudes towards rodent control in relation to LF in Southwestern Nigeria.

Correspondence to: Adebimpe Wasiu Olalekan
(lekanadebimpe@gmail.com)

Received: 23.09.14 - Revised: 02.04.15 - Accepted: 08.04.15 -
Published: 25.05.15

2 Methods

The study was carried out in Osogbo metropolis, the capital of Osun State in Southwestern Nigeria. The city has a population of about 750,000 people (National Population Commission [Nigeria], 2006), divided among three Local Governments (LGs), namely Osogbo, Egbedore and Olorunda LGs. It is inhabited mainly by people of the Yoruba-speaking ethnic group, with trading being their major occupation. There are about six slum settlements in two of the LG areas and none in Egbedore LG area. These slums are characterised by overcrowding of both houses and humans. There is a general and a teaching hospital, as well as numerous primary health care centres and private hospitals providing health services within the city.

2.1 Participants

The target population was made up of adult men and women within the age group of 18-65 years and living in slum areas in Osogbo. Eligible respondents should have been living in a slum community for a period of about 5 years. Using the formula for the estimation of sample size for populations greater than 10,000 (Araoye, 2004), and a community awareness prevalence rate of 48.0% (Richmond & Bagloe, 2003), a sample size of 384 was calculated. This was increased to 500 after adjusting for non-response and attrition.

A multistage sampling technique was employed. Osogbo was purposively divided into two groups, namely the slum wards ($N = 6$) and the non-slum wards ($N = 24$). Slum wards are those wards where slum settlements exist, while there are no slum settlements in the non-slum wards. In Stage 1, four of the six slum wards were randomly selected by random sampling through simple balloting. An equal number of questionnaires (96) was allocated to each of the four slum wards. The enumeration areas (EAs) used for the 2006 national population census were then used to delineate wards into communities. In Stage 2, two communities were randomly selected per ward by employing simple balloting. Subsequently, two streets per community were randomly selected through simple balloting in Stage 3. On a street, houses were selected using a systematic random technique of one in three after obtaining a sampling frame or list of streets and houses, starting with the odd-numbered houses on the right and even numbers on the left in Stage 4. All adults aged between 18 and 65 years in selected houses were interviewed. This process continued until allocated questionnaires were exhausted. In the case of uncompleted questionnaires remaining per street and per community, another EA community was chosen randomly and the sampling procedure repeated again.

2.2 Procedure

The study employed a cross-sectional descriptive design. Research instruments used were pre-tested semi-structured interviewer-administered questionnaires. Each questionnaire consisted of four sections. Section A examined the socio-demographic characteristics of the study population. Section B assessed awareness and knowledge about rodents and LF transmission. Section C dealt with awareness of LF, while Section D dealt with rodent control. The questionnaire administration was conducted mainly in the evenings of weekdays and on weekends by trained interviewers, who were community health workers conversant with the area. For the uneducated respondents, a vernacular version of the questionnaire was prepared, translated and back-translated between English and the native Yoruba language, to reduce inter-observer variation in the interpretation of responses during the administration of the questionnaires.

2.3 Ethical approval

Ethical approval to conduct the study was obtained from UNIOSUN Health Research Ethics Committee, with further permission from the State Ministry of LG affairs. Written informed consent was obtained from each of the respondents with subsequent signing or thumb printing.

2.4 Data analysis

Data collected were checked manually for errors and then double-entered and analysed on a computer using SPSS software. Relevant frequency tables and charts were generated. Composite knowledge and attitude scores were calculated. For knowledge, the 10-point knowledge questions were scored as +1 for a favourable, or positive, or correct answer, while -1 was scored for an unfavourable, or negative, or incorrect answer. Aggregate scores of 5 and above were regarded as 'good' while scores amounting to less than five were regarded as 'poor'. Associations between categorical variables were analysed using the Chi-square test at a level of significance of $p < 0.05$. Bivariate and multivariate analyses were carried out, with the statistical level of significance considered at $p < 0.05$ for all inferential statistics.

Table 1: Demographic characteristics of respondents.

Variables	Frequency	Percentage
Age group (years)		
18-30	151	30.2
31-40	147	29.4
41-50	83	16.6
51-60	76	15.2
61-70	43	8.6
Sex		
Male	222	44.4
Female	278	55.6
Marital status		
Single	147	29.4
Married	292	58.4
Other	61	12.2
Educational status		
Nil formal	85	17
Primary	123	24.6
Secondary	222	44.4
Tertiary	45	9
Other	25	5
Occupation		
Artisan	113	22.6
Business	158	31.6
Civil servant	34	6.8
Farmer	66	13.2
Unemployed	104	20.8
Other	25	5
Religion		
Christian	80	16
Muslim	415	83
Traditional	2	0.4
Other	3	0.6

3 Results

The mean age of respondents was 39.8 years (+3.2 years), with 151 (30.2%) of respondents being in the 18-30 years age group. 55.6% of the participants ($N = 278$) were females, 58.4% ($N = 292$) were married, while 17.0% ($N = 85$) had no formal education. These results, together with other findings on the participant group characteristics, are listed in Table 1.

Figure 1 shows percentage scores related to participants' knowledge of the epidemiology, causes, transmission as well as prevention and control of LF. The absolute majority of respondents reported poor knowledge related to each component (80.6% for occurrence, 85.9% for causes, 83.0% for disease transmission and 86.1% for prevention and control). Table 2 shows that 101 participants (20.2%) had heard about LF, with television and radio being the source of information among 74 of them (73.3%). Overcrowding (more than two people living with respondents in the same room) was reported in 215 (43.0%) of respondents' houses. Only 201 (40.2%) of respondents said they had separate rooms for keeping their loads and luggage. 171 respondents (43.3%) reported seeing a rat in their houses within the previous 24 hours. Only 36 (9.1%) claimed to never have seen a rat in their houses. 277 participants (55.4%) said that rats moved freely in their houses, while 206 (41.2%) reported that they often saw rats cross between houses. As a means to rodent control, 78 participants (15.6%) reported killing some rats physically, 162 (32.4%) used chemicals, while 143 (28.6%) set traps for them. 60 respondents (12.0%) said

the rats eventually escaped. 256 respondents (51.2%) viewed rats as potential transmitters of diseases.

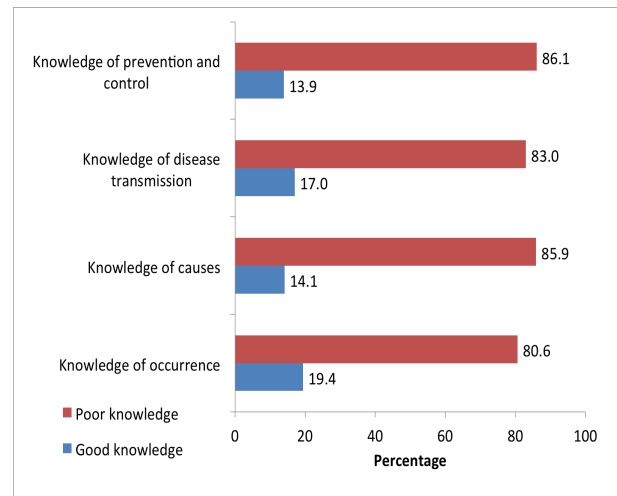


Figure 1: Knowledge of occurrence, causes, transmission and control of Lassa fever.

Table 2: Awareness about rodents and Lassa fever.

Variables	Frequency	Percentage
Heard about Lassa fever		
Yes	101	20.2
No	399	79.8
Sources of information ($N = 101$)		
TV/radio	74	73.3
Textbooks	5	4.9
Health care workers	14	13.9
Other	8	7.9
Number of people living with respondents in same room		
0	87	17.4
1	77	15.4
2	121	24.2
>2 (overcrowding)	215	43.0
Respondents having separate room for load or a store	201	40.2
Respondents seeing a rat in their household ($N = 395$)		
in the last 24 hours	171	43.3
over the past month	188	47.6
never	36	9.1
Rats move freely in my house	277	55.4
Rats often seen crossing between houses	206	41.2
What do you normally do when you see rats in the house?		
Many escape	60	12.0
Kill some physically	78	15.6
Use chemicals	162	32.4
Set traps	143	28.6
Other	57	11.4
These rats could transmit diseases		
Yes	256	51.2
No	198	39.6
Don't know	46	9.2

Table 3: Environmental factors and recommendations for rodent control.

Variables	Frequency	Percentage
Type of toilet		
Pit hole	200	40.0
Ventilated Improved Pit	16	3.2
Water closet	143	28.6
Other	96	19.2
Missing	45	9.0
All food items usually covered/not exposed	395	79.0
Refuse/remaining food disposal		
Dustbin at home	107	21.4
Dustbin outside home	202	40.4
Dustbin far away	145	29.0
Other	46	9.2
How often refuse accumulates		
Daily	296	59.2
Twice a week	56	11.2
Weekly	65	13.0
Monthly	5	1.0
Other	78	15.6
Often eats bush rats	101	20.2
Means of rodent control ($N = 500$)		
Personal hygiene	434	86.8
Environmental hygiene	434	86.8
Cover food and water properly	427	85.4
Cook food thoroughly	417	83.4
Block all rat hideouts	352	70.4
Store grains, food items in containers with cover	436	87.2
Proper refuse disposal	446	89.2
Keep pets in the house	315	63.0
Periodic fumigation	332	66.4
Dispose of garbage far away from home	382	76.4
Avoid crowding - loads and people	374	74.8
Public health education	425	85.0
Would like to take every positive step towards rodent control in households and hospitals	313	62.6
Would like to give public health education to households on prevention and control of rodents	192	38.4

Table 3 shows environmental factors favouring rodent transmission of LF and recommendations for rodent control. The type of toilet used by the majority of respondents was the pit latrine ($N = 200$; 40.0%). For disposal of refuse and residual food items, most respondents used a home dustbin placed outside ($N = 202$; 40.4%), despite daily accumulation of refuse noted by 296 (59.2%) of respondents. 101 participants (20.2%) often ate bush rats. There were 313 participants (62.6%) who claimed that they would like to take every positive step towards rodent control in households, while 192 (38.4%) were interested in giving public health education to households on prevention and control of rodents. Recommendations for rodent control made by the re-

spondents included good personal hygiene ($N = 434$; 86.8%), good environmental hygiene ($N = 434$; 86.8%), proper covering of food and water ($N = 427$; 85.4%), cooking food thoroughly ($N = 417$; 83.4%), blocking all rat hideouts ($N = 352$; 70.4%), storing grains and food in containers having a cover ($N = 436$; 87.2%), proper refuse disposal ($N = 446$; 89.2%), keeping pets in the house ($N = 315$; 63.0%), periodic fumigation ($N = 332$; 66.4%), disposing of garbage far away from the house ($N = 382$; 76.4%), avoiding overcrowding in terms of load and people ($N = 374$; 74.8%) and giving public health education ($N = 425$; 85.0%).

Table 4: Association between awareness of Lassa fever and selected variables.

Bivariate analysis				
Variables	Have heard about Lassa fever		X ² value	p-value
	Yes	No		
Sex				
Male	66	156	22.49	<0.001
Female	35	243		
Education level				
Nil formal	17	68	0.003	0.96
Had formal education	84	331		
Ready to take positive steps towards rodent control				
Yes	71	242	3.203	0.074
No	30	157		

Binary logistic regression: prediction of having heard about Lassa fever by selected variables

Variables	OR	95% CI		p-value
		Lower	Upper	
Sex (reference category = female)	2.94	1.86	4.636	<0.001
Education (reference category = informal education)	0.98	0.55	1.764	0.96
Ready to take positive steps towards rodent control (reference category = no)	1.54	0.958	2.46	0.075

Table 4 shows a statistically significant association between having heard about LF and respondents' gender ($p < 0.05$), while no such association exists with education level and readiness to take positive steps towards rodent control ($p > 0.05$). Males were three times more likely to have heard about LF compared to females (Odds Ratio (OR) = 2.94, 95% Confidence Interval (CI) = 1.860 - 4.636, $p < 0.001$). Thus, male gender predicted awareness of LF. There was no difference in the likelihood of respondents with formal education being aware of LF compared to those with informal education (OR = 0.98, 95% CI = 0.550 - 1.764, $p = 0.960$). Respondents who had heard about LF were 1.54 times more likely to be willing to take every positive step towards rodent control in households (OR = 1.5, 95% CI = 0.958 - 2.460, $p = 0.075$).

4 Discussion

In this study, about one-fifth of respondents were aware of LF. This figure is lower compared to a study that reported a community figure of about half of respondents, though endemic communities were studied with a sample size of 231 (Cohen, 2003). Awareness can be described as a precursor of seeking more in-depth knowledge about the core subject under consideration, LF in this case. The sources of information on LF identified in this study agreed with findings from another similar study by Aigbiremolen et al. (2012). The media remain a veritable means of disseminating information about health and health-related events, although bias of perception may result (Wilson et al., 2004; Young, Norman & Humphreys, 2008).

Most studies reviewed did not break down the knowledge of LF into occurrence, causes, transmission and prevention and control, as in the present study. Rather, they addressed generalised knowledge towards LF as a disease. However, less than one fifth of the respondents in the current study had good knowledge in each of the four categories examined. This is rather low when compared with another community-based study in which just under half of the respondents had good knowledge of LF (Richmond & Bagloe, 2003). However, our figure was higher when compared with another community-based Nigerian study ($N = 380$) that reported 7.4% of respondents having good knowledge of LF (Oladeinde, Omoregie & Odia, 2014). While these differences in figures call for concern, they point towards a growing need to step up awareness and, subsequently, in-depth knowledge of LF and rodent control.

Governments' commitment to all citizens of the world towards assisting them to live a socially acceptable and economically productive life includes safe and quality housing. Thus, poor quality housing is an infringement on the rights of all humans to a standard of living that is adequate for health. Among the vulnerability of those without adequate shelter is the risk of spreading of disease by rodents and other pests. Thus, the overcrowding (more than two people living together in a room) reported in the homes of just less than half of the respondents in this study suggests that houses in slums are inadequate in terms of space and, perhaps, facilities. Only about two-fifths of participants reported having a separate room for loads. This arrangement could favour breeding and movement of rodents within the house, as well as cross-breeding from one house to the other. In this study, half of the

respondents reported that rats moved freely in their house, two-fifths said they crossed between houses, while another half said they can transmit disease. This supports another study in which respondents associated rodents' free movement and consumption with occurrence and outbreak of LF infection (El-Yuguda, Baba & Aliyu, 2009). A relationship also exists between housing quality and risk of LF in underserved communities (Bonner et al., 2007). Houses in slums, like those in camps, are usually constructed primarily of mud bricks and are less likely to have adequate facilities for waste management. In support of findings from this research, other studies have shown that houses of good quality and external hygiene are more likely to have multimammate rat infestation than houses built of mud brick or mud and wattle walls (Innebah, Brewah & Francis, 2004; Moses et al., 2009). Thus, the ability of respondents to observe the numerous rodent control measures identified may depend on the adequacy of their houses and their attitude towards waste management. Infection gaps have also been found to exist in areas with poor waste management and sanitation (Hodges, 2001). Among the many ways of rodent contact control is the protection of food and the provision of adequate food storage facilities. This is also supported by another study (World Health Organization, 2005), thus stressing the need to put food away from contact with rodents.

5 Conclusions

Poor awareness and knowledge of LF was found among community members studied in this investigation. Overcrowding and poor housing facilities can only worsen the risk of breeding and free movement of rodents in these slum communities. Poor housing may not guarantee respondents the important task of executing all the rodent control strategies mentioned in this study. It is thus important to raise community awareness about LF. It is important for the concerned authorities to assist in providing adequate housing for all, as this can lead to better rodent control and thus a reduction in prevalence of LF in our societies.

6 Acknowledgements

The author would like to thank the State Ministry of Urban and Regional Planning for its cooperation during data collection. The cooperation of community leaders and all community members who took part in the study is also deeply appreciated.

7 Funding

This research has received no specific grant from any funding agency in the public, commercial or non-profit sectors.

8 Conflicts of Interest

The author reports no conflicts of interest.

References

- Aigbiremolen, A.O., Duru, C.B., Awunor, N.S., Abejegah, C., Abah, S.O., Asogun, A.D. & Eguavoen, O.L. (2012) Knowledge and application of infectious disease control measures among primary care workers in Nigeria: the Lassa fever example. *International Journal of Basic, Applied and Innovative Research*, 1(4), pp. 122-129.
- Araoye, M.O. (2004) *Research Methodology with Statistics for Health and Social Sciences*. Ilorin, Nigeria: Nathadex Publishers.
- Bonner, P.C., Schmidt, W.P., Belmain, S.R., Oshin, B., Baglolle, D. & Borchert, M. (2007) Poor housing quality increases risk of rodent infestation and Lassa fever in refugee camps of Sierra Leone. *American Journal of Tropical Medicine and Hygiene*, 77 (1), pp. 169-175.
- Cohen, B. (2003) Urban growth in developing countries: a review of current trend and a caution regarding existing forecasts. *World Development*, 32(1), pp. 23-51.
- Daniel, K.J., Bailor, M.B., Ross, R.A., Temple, B.A., Moses, L.M. & Bausch, D.G. (2013) Housing equity for health equity: a rights-based approach to the control of Lassa fever in post-war Sierra Leone. *BMC International Health and Human Rights*, 13(2), pp. 36-43.
- El-Yuguda, A.D., Baba, S.S., & Aliyu, A.M. (2009) Peridomestic rodents and Lassa fever virus infection of humans in urban and rural communities in Borno state, Nigeria. *Nigerian Veterinary Journal*, 30(2), pp. 65-70.
- Hala, I.A. (2013) Health effect of slums: a consequence of urbanization. *Scholarly Journal of Medicine*, 3 (1) pp.7-14.
- Hodges, A.O. (2001) *Children's and Women's Rights in Nigeria: A wake-up call*. Abuja: National Planning Commission, Nigeria/UNICEF 2001.
- Innebah, T., Brewah, F. & Francis, T. (2006) *The 2004 Population and Housing Census: Analytical report on poverty*. Republic of Sierra Leone.
- Karija, M.K., Shihua, Q.I. & Lukaw, Y.S. (2013) The impact of poor municipal solid waste management practices and sanitation status on water quality and public health in cities of the least developed countries: the case of Juba, South Sudan. *International Journal of Applied Science and Technology*, 3(4), pp.87-99.
- Lopez, A.D. & Mathers, C.D. (2006) Measuring the global burden of disease and epidemiological transitions: 2002-2030. *Annals of Tropical Medicine and Parasitology*, 100 (5 & 6), pp. 481-99.
- Lopez, A.D., Mathers, C.D., Ezzati, M., Jamison, D.T. & Murray, C.J. (2006) Global and regional burden of disease and risk factors, 2001: systematic analysis of population health data. *Lancet*, 367(9524), pp.1747-57.
- Moses, L.M., Adams, K.L., Kargbo, K., Koninga, J., Veltus, E., Lewinski, J.P., Fonnio, R., Kanneh, L.D., Robert, W., Bangura, J.J., Lungay, V.K., Garry, R.F., Rogers, D.S. & Bausch, D.G. (2009) Household predictors of abundance of the Lassa virus reservoir, *Mastomys natalensis*, in the Eastern Province of Sierra Leone. Abstract, *58th Annual Meeting of the American Society of Tropical Medicine and Hygiene*. Washington, DC.
- National Population Commission [Nigeria] (2006) *Nigeria Demographic and Health Survey*. Calverton Maryland: National Population Commission and ORC Macro.
- Oladeinde, B.H., Omoregie, R & Odia, I. (2014) Public awareness of Lassa fever in three rural communities of Nigeria. *International Journal of Health Promotion and Education*. doi: 10.1080/14635240.2014.968288.
- Omole, E.K. (2003) Urban renewal theory and practice: some lessons from Nigeria. *International Journal of Environmental Issues*, 1(1), pp.115-123.
- Richmond, K. & Bagloe, D.J. (2003) Lassa fever: epidemiology, clinical features, and social consequences. *British Medical Journal*, 327(7426), pp. 1271-1275.
- Rodhain, F. (1996) Les zoo-anthropozoonoses impliquant des rongeurs: considérations épidémiologiques. *Bulletin of the Exotic Pathology Society*, 89, pp.5-11.
- Tobin, E.A., Asogun, D., Happi, C., Ogbaini, E. & Gunther, S. (2014) Risk factors for Lassa fever in endemic communities of Edo State, Nigeria. *International Journal of Infectious Diseases*, 21(1), pp. 258-259.
- United Nations (2010) *World Urbanization Prospects: The 2009 revision*. [Online] Available from: <http://esa.un.org/unpd/wup/index.htm> [Accessed 12th June 2014].
- United Nations Human Settlements Programme (UN-HABITAT)

- (2003) Monitoring housing rights. *United Nations Housing Rights Programme, Working Paper, No.1*. Nairobi: UN-HABITAT Information Services Section.
- World Health Organization (2005) Update on Lassa fever in West Africa. *WHO Weekly Epidemiologic Records*, 10(11), pp. 86-87.
- Wilson, K., Code, C., Dornan, C., Ahmad, N. & Hebert, P. (2004) The reporting of theoretical health risks by the media: Canadian newspaper reporting of potential blood transmission of Creutzfeldt-Jakob disease. *BMC Public Health*, 4(1), doi: 10.1186/1471-2458-4-1.
- Young, E.M., Norman, R.G. & Humphreys, R.K. (2008) Medicine in the popular press: the influence of the media on perceptions of disease. *PLOS One*, 3(10), doi: 10.1371/journal.pone.0003552.

Table of Contents

Malta Journal of Health Sciences Volume 2 - Issue 1 (May 2015)

Editorial

-
- 1 Guest Editorial
Martin Ward

Regular Articles

-
- 2 The nurse is present: a review exploring the temporality of illness through presence and narrative, an artist's perspective Review Article
Pamela Baldacchino
- 9 Investigating the effect of long-term musical experience on the auditory processing skills of young Maltese adults Research Article
Martha Pace and Nadine Calleja
- 16 The use of joint attention in the naturalistic setting in children with Autism Spectrum Disorders Research Article
Cheryl Dalli and Joseph Agius

Commentary

-
- 22 The current situation for the water sources in the Maltese Islands
David Spiteri, Chris Scerri and Vasilis Valdramidis

Short Communication

-
- 26 Community awareness and perception towards rodent control: implications for prevention and control of Lassa fever in urban slums of South-western Nigeria
Adebimpe Wasiu Olalekan
-