

XJENZA

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Science Journal of the Malta Chamber of Scientists

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2018–

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Xjenza Online Vol. 6 Iss. 1 - 2018

2013–2017

Editor: Giuseppe Di Giovanni

Associate Editors: *David Magri, Ian Thornton, Ian Cassar, Philip Farrugia, Sebastiano D'Amico, Nicholas Sammut, David Mifsud, Godfrey Baldacchino, Liberato Camilleri, Carmel Cefai*

Xjenza Online Vol. 5 Iss. 2 - 2017

Xjenza Online Vol. 5 SI MNS Proceedings - 2017

Xjenza Online Vol. 5 Iss. 1 - 2017

Xjenza Online Vol. 5 Virtual Issue COST - 2017

Xjenza Online Vol. 4 Iss. 2 - 2016

Xjenza Online Vol. 4 Iss. 1 - 2016

Xjenza Online Vol. 3 Iss. 2 - 2015

Associate Editors: *David Magri, Ian Thornton, Ian Cassar, Philip Farrugia, Sebastiano D'Amico, Nicholas Sammut, Joseph Galea, David Mifsud, Sandro Lanfranco, Mario Valentino, Godfrey Baldacchino, Liberato Camilleri*

Xjenza Online Vol. 3 Iss. 1 - August 2015

Xjenza Online Vol. 2 Iss. 2 - October 2014

Xjenza Online Vol. 2 Iss. 1 - March 2014

Xjenza Online Vol. 1 Iss. 2 - October 2013

Xjenza Online Vol. 1 Iss. 1 - March 2013

2003–2007

Editors: Joseph N. Grima and Richard Muscat

Xjenza Vol. 12 - 2007

Xjenza Vol. 11 - 2006

Xjenza Vol. 10 - 2005

Xjenza Vol. 9 - 2004

Xjenza Vol. 8 - 2003

1996–2002

Editor: Angela Xuereb

Associate Editor: *Richard Muscat*

Xjenza Vol. 7 - 2002

Xjenza Vol. 6 - 2001

Associate Editors: *Martin Ebejer and Richard Muscat*

Xjenza Vol. 5 - 2000

Xjenza Vol. 4 Iss. 2 - 1999

Xjenza Vol. 4 Iss. 1 - 1999

Associate Editors: *Martin Ebejer, Richard Muscat, and Christian A. Scerri*

Xjenza Vol. 3 Iss. 2 - 1998

Xjenza Vol. 3 Iss. 1 - 1998

Associate Editors: *Martin Ebejer, Richard Muscat, Christian A. Scerri and Emmanuel Sinagra*

Xjenza Vol. 2 Iss. 2 - 1997

Xjenza Vol. 2 Iss. 1 - 1997

Xjenza Vol. 1 Iss. 2 - 1996

Xjenza Vol. 1 Iss. 1 - 1996

Scope of Journal

Xjenza Online is the Science Journal of the Malta Chamber of Scientists and is published in an electronic format. Xjenza Online is a peer-reviewed, open access international journal. The scope of the journal encompasses research articles, original research reports, reviews, short communications and scientific commentaries in the fields of: mathematics, statistics, geology, engineering, computer science, social sciences, natural and earth sciences, technological sciences, linguistics, industrial, nanotechnology, biology, chemistry, physics, zoology, medical studies, electronics and all other applied and theoretical aspect of science.

The first printed issue of the journal was published in 1996 and the last (Vol. 12) in 2007. The publication of Xjenza was then ceased until 2013 when a new editorial board was formed with internationally recognised scientists, and Xjenza was relaunched as an online journal, with two issues being produced every year. One of the aims of Xjenza, besides highlighting the exciting research being performed nationally and internationally by Maltese scholars, is to provide a launching platform into scientific publishing for a wide scope of potential authors, including students and young researchers, into scientific publishing in a peer-reviewed environment.

Instructions for Authors

Xjenza is the Science Journal of the Malta Chamber of Scientists and is published by the Chamber in electronic format on the website: <http://www.mcs.org.mt/index.php/xjenza>. Xjenza will consider manuscripts for publication on a wide variety of scientific topics in the following categories

1. Research Articles
2. Communications
3. Review Articles
4. Notes
5. Research Reports
6. Commentaries
7. News and Views
8. Invited Articles and Special Issues
9. Errata

Research Articles form the main category of scientific papers submitted to Xjenza. The same standards of scientific content and quality that applies to Communications also apply to Research Articles.

Communications are short peer-reviewed research articles (limited to three journal pages) that describe new important results meriting urgent publication. These are often followed by a full Research Article.

Review Articles describe work of interest to the wide community of readers of Xjenza. They should provide an in-depth understanding of significant topics in the sciences and a critical discussion of the existing state of knowledge on a topic based on primary literature sources. Review Articles should not normally exceed 6000 words. Authors are strongly advised to contact the Editorial Board before writing a Review.

Notes are fully referenced, peer-reviewed short articles limited to three journal pages that describe new theories, concepts and developments made by the authors in any branch of science and technology. Notes need not contain results from experimental or simulation work.

Research Reports are extended reports describing research of interest to a wide scientific audience characteristic of Xjenza. Please contact the editor to discuss the suitability of topics for Research Reports.

Commentaries: Upon Editor's invitation, commentaries discuss a paper published in a specific issue and should set the problems addressed by the paper in the wider context of the field. Proposals for Commentaries may be submitted; however, in this case authors should only send an outline of the proposed paper for initial consideration. The contents of the commentaries should follow the following set of rules: 3000 words maximum, title 20 words maximum, references 10 maximum (including the article discussed) and figures/tables 2 maximum.

News and Views: The News section provides a space for articles up to three journal pages in length describing leading developments in any field of science and technology or for reporting items such as conference reports. The Editor reserves the right to modify or reject articles for consideration as News.

Invited Articles and Special Issues: Xjenza regularly publishes Invited Articles and Special Issues that consist of articles written at the invitation of the Editor or another member of the editorial board.

Errata: Xjenza also publishes errata, in which authors correct significant errors of substance in their published manuscripts. The title should read: Erratum: "Original title" by ***, Xjenza, vol. *** (year). Errata should be short and consistent for clarity.

Submission of Manuscripts

Manuscripts should be sent according to the guidelines given hereafter to xjenza@mcs.org.mt.

Referees All manuscripts submitted to Xjenza are peer reviewed. Authors are requested to submit with their manuscript the names and addresses of three referees, preferably from overseas. Every effort will be made to use the recommended reviewers; however the editor reserves the right to also consult other competent reviewers.

Conflict of Interest Authors are expected to disclose any commercial or other types of associations that may pose a conflict of interest in connection to with the submitted manuscript. All funding sources supporting the work, and institutional or corporate affiliations of the authors, should be acknowledged on the title page or at the end of the article.

Policy and Ethics The work presented in the submitted manuscript must have been carried out in compliance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans (<http://www.wma.net/en/30publications/10policies/b3/index.html>); EU Directive 2010/63/EU for animal experiments (http://ec.europa.eu/environment/chemicals/lab_animals/legislation_en.htm); Uniform Requirements for manuscripts submitted to Biomedical journals (<http://www.icmje.org>). This must be stated at an appropriate point in the article.

Submission, Declaration and Verification Author(s) must only submit work that has not been published previously (except in the form of an abstract or as part of a published lecture or academic thesis), that is not under consideration for publication elsewhere, that has been approved for publication by all authors, and tacitly or explicitly, by the responsible authorities where the work was carried out, and that, if accepted, will not be published elsewhere in the same form, in English or in any other language, including electronically, without the written consent of the copyright-holder.

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personal communications are discouraged; however, corresponding authors are expected to obtain permission in writing from at least one author of such materials.

Preparation of Manuscripts

Xjenza accepts submissions in MS Word, Libre Office Writer and L^AT_EX, the latter being the preferred option. Anyone submitting in L^AT_EX should use the journal template, the latest version of which can be found at <http://github.com/hicklin/Xjenza-Journal-Template>. All the necessary files to run the L^AT_EX document should be supplied together with the rendered PDF.

If a word processor is used the styling should be kept to a minimum. Bold face and italic fonts, as well as subscript and superscript text may be used as required by the context. Text should be in single-column format and the word processor options should not be used in order to justify text or hyphenate words. Alongside the native format of the word processor, a PDF file, generated by the word processor, must be provided. Furthermore, artwork should be in accordance with the artwork guidelines given below and must be submitted separately from the word processor file. Similarly, the bibliographic data of the cited material should be submitted separately as an Endnote (*.xml), Research Information Systems (*.ris), Zotero Library (zotero.splite) or a Bib_TE_X (*.bib) file.

Article Structure

A manuscript for publication in Xjenza will typically have the following components: Title page, Abstract, Keywords, Abbreviations, Introduction, Materials and Methods, Results, Discussion, Conclusions, Appendices and References.

The manuscript will be divided into clearly defined and numbered sections. Each numbered subsection should have a brief heading. Each heading should appear on its own separate line. Subsections should be used as much as possible when cross-referencing text, i.e. refer to the subsection by the section number.

Title page

- The title should be concise yet informative. Titles are often used in information-retrieval systems. Avoid abbreviations and formulae where possible.
- Author names and affiliations. Indicate the authors' affiliation addresses (where the actual work was done) below the names. Indicate all affiliations with a lower-case superscript number immediately after each author's name and in front of the appropriate address. Provide the full postal address of each affiliation, including the country name and, if available, the e-mail address.
- Corresponding author. Clearly indicate who will handle correspondence at all stages of refereeing and publication, including post-publication. Ensure that telephone and fax numbers (with country and area code) are provided in addition to the e-mail address and complete postal address. Contact details must be kept up to date by the corresponding author.
- Present/permanent address. If an author has changed the address since the work described, this can be indicated as a footnote to the author's name. The address at which the author actually did the work must be retained as the main, affiliation address. Superscript Arabic numerals are used for such footnotes.

Abstract A concise and factual abstract is required of up to about 250 words. The abstract should state briefly the background and purpose of the research, the principal results and major conclusions. An abstract is often presented separately from the article, so it must be able to stand alone. For this reason, references and non-standard abbreviations should be avoided. If

essential, these must be defined at first mention in the abstract itself.

Abbreviations Define abbreviations that are not standard in this field in a footnote to be placed on the first page of the article. Such abbreviations that are unavoidable in the abstract must be defined at their first mention as well as in the footnote and should be used consistently throughout the text.

Introduction State the objectives of the work and provide an adequate background, avoid a detailed literature survey or a summary of the results.

Materials and Methods Provide sufficient detail to allow the work to be reproduced. Methods already published should be indicated by a reference: only relevant modifications should be described.

Results Results should be clear and concise. Numbered/tabulated information and/or figures should also be included.

Discussion This should explore the significance of the results of the work, yet not repeat them. Avoid extensive citations and discussion of published literature. A combined section of Results and Discussion is often appropriate.

Conclusions The main conclusions based on results of the study may be presented in a short Conclusions section. This may stand alone or form a subsection of a Discussion or Results and Discussion section.

Appendices Formulae and equations in appendices should be given separate numbering: Eq. (A.1), Eq. (A.2), etc.; in a subsequent appendix, Eq. (B.1) and so on. Similarly for tables and figures: Table A.1; Fig. A.1, etc.

Acknowledgements Collate acknowledgements in a separate section at the end of the article before the references. Do not include them on the title page, as a footnote to the title or otherwise. List here those individuals who provided assistance during the research (e.g., providing language help, writing assistance or proof reading the article, etc.).

Units Follow internationally accepted rules and conventions: use the international system of units (SI). If other units are mentioned, please give their equivalent in SI. Anyone using L^AT_EX should use the package `siunitx` in all cases.

Footnotes Footnotes should be used sparingly. Number them consecutively throughout the article, using superscript Arabic numbers. Many word processors build footnotes into the text, and this feature may be used. Should this not be the case, indicate the position of footnotes by a superscript number in the text and list the footnotes separately at the end of the article. Do not include footnotes in the Reference list.

Table Footnotes Indicate each footnote in a table with a superscript lower case letter.

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- Make sure you use uniform lettering and sizing of your original artwork.
- Save text in illustrations as 'graphics' or enclose the font.
- Only use the following fonts in your illustrations: Arial, Courier, Times, Symbol or Computer Modern Roman, the latter is preferred.
- Number the illustrations according to their sequence in the text.
- Name your artwork files as 'fig x ' or 'tab x ' where x corresponds to the sequence number in your document.
- Provide captions to illustrations separately.
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Formats Regardless of the application used, when your electronic artwork is finalised its file format should be one of the following (note the resolution requirements for line drawings, halftones, and line/halftone combinations given below):

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- JPEG or PNG: Color or grayscale photographs (halftones): always use a minimum of 300 dpi.
- JPEG or PNG: Bitmapped line drawings: use a minimum of 1000 dpi.
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Figure Captions Ensure that each illustration has a caption. Supply captions separately, not attached to the figure. A caption should comprise a brief title (not on the figure itself) and a description of the illustration. Keep text in the illustrations themselves to a minimum, but explain all symbols and abbreviations used.

Tables Number tables consecutively in accordance with their appearance in the text. Place footnotes to tables below the table body and indicate them with superscript lowercase letters. Avoid vertical rules. Be moderate with the use of tables and ensure that the data presented in tables do not duplicate results described elsewhere in the article. Large tables should be submitted in CSV format.

Citations and References Reference and citation styles for manuscripts submitted to Xjenza should be in accordance to the APA v6 style.

Citation in text References to cited literature in the text should be given in the form of an author’s surname and the year of publication of the paper with the addition of a letter for references to several publications of the author in the same year. For further information regarding multiple authors consult the APA v6 guidelines. Citations may be made directly

Kramer et al. (2010) have recently shown ...
or parenthetically

as demonstrated (Allan, 2000a, 2000b, 1999; Allan and Jones, 1999).

Groups of references should be listed first alphabetically, then chronologically. When writing in L^AT_EX use `\textcite{}` and `\parencite{}` for the respective cases mentioned.

The reference section Every reference cited in the text should also be present in the reference list (and vice versa). The reference list should also be supplied as an Endnote (*.xml), Research Information Systems (*.ris), Zotero Library (zotero.splite) or a BiB_TE_X (*.bib) file. Unpublished results and personal communications are not recommended in the reference list, but may be mentioned in the text. If these references are included in the reference list they should follow the standard reference style of the journal and should include a substitution of the publication date with either ‘Unpublished results’ or ‘Personal communication’. Citation of a reference as ‘in press’ implies that the item has been accepted for publication.

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.

Consult the APA v6 guidelines for multiple authors. Below are some examples of referencing different bibliographic material.

Reference to a Journal Publication:

- Agree, E. M. and Freedman, V. A. (2011). A Quality-of-Life Scale for Assistive Technology: Results of a Pilot Study of Aging and Technology. *Phys. Ther.*, 91(12):1780–1788.
- McCreadie, C. and Tinker, A. (2005). The acceptability of assistive technology to older people. *Ageing Soc.*, 25(1):91–110.

Reference to a Book:

- Brownell, B. (2003). *Assistive Technology and Telecare: Forging Solutions for Independent Living*. Policy Press, Bristol.
- Fisk, M. J. (2003). *Social Alarms to Telecare: Older People’s Services in Transition*. Policy Press, Bristol, 1st edition.

Reference to a Chapter in an Edited Book:

- Brownell, S. and Bradley, D. (2003). New Generations of Telecare Equipment. In *Assist. Technol. Telecare Forg. Solut. Indep. Living*, pages 39–50.

Web references The full URL should be given together with the date the reference was last accessed. Any further information, if known (DOI, author names, dates, reference to a source publication, etc.), should also be given. Web references can be listed separately or can be included in the reference list.

References in a Special Issue Please ensure that the words ‘this issue’ are added to any references in the list (and any citations in the text) to other articles in the same Special Issue.

Journal Abbreviations Journal names should be abbreviated according to:

- Index Medicus journal abbreviations: <http://www.nlm.nih.gov/tsd/serials/lji.html>;
- List of title word abbreviations: <http://www.issn.org/2-22661-LTWA-online.php>;
- CAS (Chemical Abstracts Service): <http://www.cas.org/sent.html>.

Video data Xjenza accepts video material and animation sequences to support and enhance the presentation of the scientific research. Authors who have video or animation files that they wish to submit with their article should send them as a separate file. Reference to the video material should be clearly made in text. This will be modified into a linked to the paper’s supplementary information page. All submitted files should be properly labelled so that they directly relate to the video files content. This should be within a maximum size of 50 MB.

Submission check list

The following list will be useful during the final checking of a manuscript prior to sending it to the journal for review. Please consult the Author Guidelines for further details of any item.

- One author has been designated as the corresponding author with contact details:
 - E-mail address.
 - Full postal address.
 - Telephone and fax numbers.
- All necessary files have been sent, and contain:
 - All figures are given separately in PDF, SVG, JPEG or PNG format.
 - Caption for figures is included at the end of the text.
 - All tables (including title, description, footnotes) are included in the text and large tables have been given separately as CSV.
 - The reference list has been given in XML, RIS, zotero.splite or BIB file format.
- Further considerations

- Abstract does not exceed about 250 words.
- Manuscript has been ‘spell-checked’ and ‘grammar-checked’.
- References are in the required format.
- All references mentioned in the reference list are cited in the text, and vice versa.
- Bibliographic data for all cited material has been provided.
- Permission has been obtained for use of copyrighted material from other sources (including the Web).
- A PDF document generated from the word processor used is submitted.

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upon the initial electronic publication. The assigned DOI never changes. Therefore, it is an ideal medium for citing a document, particularly ‘Articles in press’ because they have not yet received their full bibliographic information. When you use a DOI to create links to documents on the web, the DOIs are guaranteed never to change.

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Editorial

My First Editorial

Cristiana Sebu^{*1}

¹*Department of Mathematics, University of Malta, Msida, Malta*

It is with mixed feelings of gratefulness and enthusiasm that I am writing my first editorial as Editor-in-Chief of Xjenza Online. I am deeply thankful to the Malta Chamber of Scientists for entrusting me with the honour and responsibility of leading this esteemed journal. Moreover, since the start of 2018 the journal has embarked on an exciting journey under the leadership of a refreshed Editorial Board. The team includes now 2 Senior Editors, Dr Sebastiano D'Amico and Prof. David C Magri, and 10 associate editors who will provide support in developing and promoting Xjenza Online, contributing review advice and leading special issues. In addition, the expanded editorial and advisory boards will greatly enhance the expertise and international reach of Xjenza Online.

Looking at the previous issues of Xjenza, I have to acknowledge the tremendous development and fantastic achievements of the journal during the past years. Xjenza has steadily been improving its quality and standards, and it is now much more than simply the Science Journal of the Malta Chamber of Scientists. The journal not only provides a dedicated forum for publishing high-quality research articles in all areas of science in the Maltese Islands, but also serves as the main launching and training platform into scientific publishing for a wide scope of potential authors, including students and young researchers, in a peer-reviewed environment.

Thus, I would like to express first my sincere gratitude and heartfelt appreciation for all of the hard work and dedication to Prof. Giuseppe Di Giovanni, who gave life back to our journal in 2013, led the journal as Editor-in-Chief for 5 years, and steered the Journal to the prominence it currently enjoys. I am delighted that Prof. di Giovanni will continue being part of the 'family' and will join us on this new venture as Publication Manager. Then, I cheerfully welcome our newly arrived associate editors, who accepted the difficult task of continuing and expanding the fine work done until now:

Dr Alexandra Bonnici, Dr Lourdes Farrugia, Dr Gianluca Valentino, and Dr Pierre Vella. Also, many, many thanks to those who have agreed to continue their contribution to Xjenza Online having already supported the journal as long-serving editorial board members: Prof. Godfrey Baldacchino, Prof. Liberato Camilleri, Gabriel Farrugia, Mr Joseph Galea, Dr Katya De Giovanni, Dr Sandro Lafranco, Prof. David Mifsud, Dr Massimo Pierucci, Dr Jackson Levi Said, and Prof Ian Thornton. Last but not least, I extend my deepest thanks to the departing associate editors (Prof. Carmel Cefai, Dr Philip Farrugia and Dr Nicholas Sammut) and editorial assistant, Sunneth Lawrence, for all the time and efforts invested into the development of the journal.

There are, of course, still many challenges ahead for the new Editorial Board: improve the visibility of the Journal not only nationally but also internationally, increase the engagement and recruitment of papers from the local scientific community, transform the Journal into an active scientific open access forum in the Mediterranean region, just to name a few...

I am pleasantly pleased that my first issue of Xjenza Online continues the trend of highlighting excellent research in a wide range of sciences of both local and international relevance, as well as being a fair reflection of the vibrant scientific research environment in Malta.

The issue opens with a thorough assessment of the oral health status and treatment needs of Gozo residents by Anne-Marie Agius et al. The study reveals a high level of unmet dental treatment needs in Gozo, and is an informative callout for a better provision of dental services, reorientation of the focus of existing services on prevention and the introduction of evidence-based preventive strategies in children.

Edward and Simon Attard-Montaldo raise important questions related to courtesy, driving manners and safety on Maltese roads, and whether these are related to driver and vehicle characteristics. The results of this

**Correspondence to:* Cristiana Sebu (cristiana.sebu@um.edu.mt)

analysis might not come as a surprise to any Maltese residents. Irrespective of Malta's general reputation for excellent hospitality and friendliness, there is a lack of courtesy on the roads and a lot of room for improvement.

Next, Lara Marie Azzopardi et al. investigates the multilevel factor structure underlying the five-subscale Strengths and Difficulties Questionnaire (SDQ) on a sample of 5200 Maltese students aged between 6 and 16 years. SDQ was initially proposed by Goodman (1997) and has been subsequently used to measure emotional, conduct, hyperactivity, peer and prosocial behavior in children.

The following article features the research carried out at the Institute of Linguistics and Language Technology of the University of Malta under the auspices of the EU-funded C.O.N.T.A.C.T. project and focuses on the verbal expression of xenophobic and homophobic attitudes in Malta. Both qualitative and quantitative methods were employed to identify the extent to which comments posted online in reaction to news reports encompassed discriminatory attitudes. The research carried out by Stavros Assimakopoulos and Rebecca Vella Muscat provides a critical insight into the intricate relationship between language and ideology which has far-reaching sociological and political implications.

Then, Theresia Dalli et al. assess the incidence of intracranial vascular malformations (IVMs) in the Maltese population, their mode of presentation, patterns of interventions, and follow-up of the lesions. The outcomes of this study are worrying in the sense that the majority of patients received no intervention in spite of the fact that IVMs may cause significant morbidity in patients and timely recognition is essential. Therefore, there is an acute need of adequate guidelines for clinicians on the evidence-based management of IVMs.

Manwel Debono's manuscript highlights some very

important findings of a survey carried out among a representative national sample of 781 employees which both confirm and refute current common knowledge about trade unions in Malta. The author pinpoints the fact that in order to prevent further decline in trade union density and membership, Maltese unions need to reorganise themselves, refocus their strategies and become more effective in attracting and retaining non-traditional members.

The minireview article by Shimul Sujit Sen and Gabriele Deidda resumes the scientific studies carried out to investigate the effect of yoga in the physiology of the body and the brain, and its possible use to ameliorate some pathological conditions. From spiritual explorations and philosophical expressions, we switch almost 'naturally' to the commentary of Giuseppe di Giovanni on the use of cannabis not for the controversial recreational purposes but as a cure for severe paediatric epilepsies. This latter article strongly emphasizes the fact that marijuana research should not be demonized, but rather be encouraged and supported as it may save millions of lives.

The issue culminates with my News article which reports on the success of the 9th International Conference "Inverse Problems: Modelling and Simulation" (IPMS 2018) which was held in Malta in May 21–25, 2018, at the Paradise Bay Hotel, which transformed Malta, at least for the years to come, in the new hub for the worldwide research community of inverse problems.

I will conclude by assuring the readers and contributors to Xjenza Online that we will try our best to improve further the content of the journal and feature the outstanding accomplishments in a wide range of sciences both in Malta and abroad.

Cristiana Sebu
Editor-in-Chief of Xjenza Online



The Oral Health Status of the Gozitan Community

Anne-Marie Agius^{*1}, Ethel Vento Zahra¹, Emad Alzoubi², Maria Luisa Gainza-Cirauqui³, Gabriella Gatt² and Nikolai Attard¹

¹Department of Oral Rehabilitation and Community Care, University of Malta Medical School, Mater Dei Hospital, Msida, Malta

²Department of Child Dental Health and Orthodontics, University of Malta Medical School, Mater Dei Hospital, Msida, Malta

³Department of Dental Surgery, University of Malta Medical School, Mater Dei Hospital, Msida, Malta

Abstract. The objectives of this study is to assess the oral health status and treatment needs of Gozo residents – a geographically isolated community. A cross-sectional study of 332 Gozitan attendees on the Mobile Dental Unit was carried out during a three-month period in 14 localities in Gozo. The participants attended for a dental check-up and indices were used to record caries, plaque, calculus, erosion, soft tissue pathologies and number of dental functional units. Of the 332 participants 76.8% presented with plaque deposits, 78% require either restorative or periodontal treatment while signs of erosive wear were present in 28% of participants. In younger age bands (0–9 and 10–19) untreated carious lesions amount to 1.34 and 1.0 (DT portion of DMFT) respectively, care index FT (filled teeth)/DMFT was 0.37 overall. Most participants in 50+ age bands had less than 10 remaining functional units. Thus, the oral health status of the Gozitan community shows a high level of unmet dental treatment needs. This underscores the need for provision of better dental services in Gozo, re-orientation of existing services to focus on prevention, and introduction of evidence-based preventive strategies in school-children.

Keywords: Gozo, oral health, outreach, mobile dental unit, DMFT, BEWE, functional units

Abbreviations

MDU – Mobile Dental Unit; DMFT – Decayed, Missing and Filled Teeth; WHO – World Health Organisation; CPITN-E – Community Periodontal Index of Treatment Needs - Epidemiology; ICDAS – Interna-

tional Caries Detection and Assessment System; BEWE – Basic Erosive Wear Examination.

1 Introduction

The Mobile Dental Unit (MDU) is a project designed and launched by the Faculty of Dental Surgery (University of Malta) in September 2015. This Unit is a truck converted into a dental clinic and is equipped to function as a stand-alone clinic on wheels. It has endless uses such as outreaches, domiciliary dentistry and reaching people who are unable to commute to other clinics for treatment, preventive dentistry and advice, education and research.

Oral diseases are highly prevalent worldwide and their repercussions are significant. Dental diseases are the fourth most expensive diseases to treat (Glick et al., 2012) and they have a great impact on people's quality of life, nutrition, function, aesthetics, speech, general health, pain and missed school and work days (Santucci & Attard, 2015, 4; Sheiham, 2005; Petersen, Bourgeois, Ogawa, Estupinan-Day & Ndiaye, 2005; Kramer et al., 2013).

In the National Oral Health Survey on children carried out during 2014/15 and in a recent study performed by Gatt et al. (2017), there were many indications that the oral health status in Gozitan children was poorer in comparison to their Maltese counterparts and when compared to that of other European countries. The Gozitan population can be considered to be a geographically isolated community in Malta's archipelago with its own health profile and requirements.

The need was therefore felt to focus on Gozo and bet-

*Correspondence to: Anne-Marie Agius (anne-marie.agius@um.edu.mt)

ter understand the situation of the island, so as to be able to propose evidence-based recommendations. The aim was to explore possible niches for better prevention and treatment services in Gozo. The ultimate aim of this being an improvement of the health of the population as a whole by starting youngsters on a positive health trajectory and providing means to help them maintain their health throughout the life-course (WHO, 2017). During Summer 2017, the Mobile Dental Unit toured Gozo providing free dental check-ups in all localities, while also promoting oral health. This study presents the findings of this cross-sectional survey.

2 Methodology

2.1 Study Sample

Patients attending for a dental check up on the Mobile Dental Unit (MDU) during a three-month campaign in Summer 2017. A convenience sample of 332 patients were screened in 14 different localities in Gozo on 17 instances.

These MDU dental visits were publicised throughout the Gozitan community through various entities namely: The Ministry for Gozo, the parish churches through the help of the Gozo Diocese, the MDU website, via respective local councils and announced verbally during our visits.

Inclusion Criteria: Residents on the island of Gozo visiting the MDU and consenting to a free dental check-up were recruited in this survey.

Exclusion Criteria: Residents who did not attend for a check-up.

2.2 Research Protocol

A detailed research protocol was prepared abiding to all the requirements as stated in the World Medical Association Declaration of Helsinki – Ethical Principles for Medical Research Involving Human Subjects, WMA General Assembly, 2008. This was submitted for consideration, guidance and approval to the Faculty of Dental Surgery Research Ethics Committee and subsequently to the University of Malta Research Ethics Committee (DENT 02.2016).

Calibration of examiners: Internationally renowned researchers in the field carried out training and calibration of examiners and scribes. Programmes organised by the Faculty of Dental Surgery included seminars, discussions and both simulation lab and clinical sessions over several days. Further calibration sessions were carried out involving duplication of examination of clinical cases in order to assess intra- and inter-examiner reliability.

An inter-rater reliability analysis using the Kappa statistic was performed to determine consistency among examiners.

2.3 Clinical Examinations

The screening was carried out inside the Mobile Dental Unit. A standardised light source, Daray X200LED examination light giving an 8.000 lx at 1 m and 32.000 lx at 0.5 m (Daray Lighting Ltd., Leighton Buzzard, Luton, UK) present on the MDU was utilised during the examination of patients.

Examiners wore individual protection equipment while carrying out dental examinations using sterile wrapped packs containing a front surface reflecting mirror and ball-ended WHO CPITN-E probe. Trained scribes recorded data onto number-coded data input sheets.

Participants were asked about their medical history, medications, smoking history, oral hygiene and dietary habits. They were then screened for number of teeth present and their condition, including restorations, dental caries, trauma, erosive tooth wear, number of functional units present, prosthetics, periodontal status including presence of plaque and calculus, and soft tissues and oral mucosal conditions.

The dental treatment needs of every individual patient were determined and patients were referred for treatment according to their need and eligibility.

2.4 Indices

Dental caries and status of teeth: The International Caries Assessment and Detection System (ICDAS) was utilised as a means of detecting and classifying carious lesions present.

ICDAS scores were later converted to DMFT for comparison with other Maltese and European values (Patel, 2012; WHO, 2016).

Plaque and Calculus were scored using the BASCD (British Association for the Study of Community Dentistry) criteria, as follows:

Plaque scores: 0- No plaque present
1- Plaque present following probing
2- Plaque present visibly

Calculus scores: 0- No calculus present
1- Calculus present following probing or visible

Functional Units: A count of pairs of anterior and posterior natural or restored teeth in occlusal contact.

Erosive tooth wear: The Basic Erosive Wear Examination Index (BEWE) was used to score an index value per participant.

2.5 Data Analysis

The data gathered from screening was inputted into Microsoft Excel®. Statistical tests were carried out with

the aid of SPSS 20.0 software (IBM Company, Chicago, IL, USA). The level of statistical significance was set at $p < 0.05$.

3 Results

3.1 Epidemiology

From a study sample of 332 participants, 182 (55%) were female and 150 (45%) were male. Average age was 36 (+/- 26) from 14 different localities in Gozo namely: Rabat (San Frangisk), Rabat (tač-Čawsli), Xewkija, Sannat, Għarb, Kerċem, San Lawrenz, Xagħra, Għajnsielem, Nadur, Qala, Munxar, Żebbuġ, Għasri.

3.2 Smoking and General Health

Only 8% of participants admitted to being smokers, while 41% (136) were on different medications. The average number of medications per day was 2.36 per person with a standard deviation of 1.5 and a range of 1–9 medications/day.

3.3 Oral Hygiene in Participants

Out of all study participants, 76.8% had plaque present on their teeth at the time of examination: 52.4% had plaque present on probing (score 1) whilst 36.7% had visible plaque present (score 2); 62% of participants had calculus deposits, and 1.97% presented with soft tissue pathologies.

3.4 Decayed, Missing and Filled Teeth (DMFT)

Figs. 1 and 2 present the DMFT and distribution of the sub-scores according to the age cohorts. It can be observed that DMFT is seen to increase with age with a peak at the 60–69 year-old age band with an average DMFT of 16. More specifically Fig. 2 presents the DMFT individual components, displaying the proportions of decayed, missing or filled teeth in each age band. It can be observed that untreated caries decreases with age and tapers beyond the age of 50 years. The inverse is true for the missing teeth component. It increases with age indicating that the care being provided is extractions rather than maintenance of the teeth through restorative procedures. Furthermore, this data gives an indication of the level of care in each group. The Care

index (FT/DMFT) is on average only 0.37 or 37%. In 12 year-olds, it amounts to only 33%. This care index is lowest at the extremes of age, the 0–9 and the 80+ age groups.

Fig. 3 illustrates how most carious lesions charted across the age bands were cavitated lesions requiring direct restorative intervention. However, 28% of lesions are still in the early reversible stage of the carious process. The younger age bands have higher percentages of reversible lesions with a maximum percentage of such lesions being that of 52 in the 40–49-year-old age band.

3.5 Missing Teeth and Functional Units

Table 1 presents the percentage of patients with missing teeth. Out of the adult population (20 yrs+; $N = 211$ patients) 139 patients (66%) had missing teeth. 24% of these patients were wearing fixed and/or removable prostheses to replace the missing teeth. The average age of the patients wearing prostheses was 64 yrs (SD 26yrs; Range 27–77 yrs).

No. of missing teeth	Percentage (no. of participants)
1–5	23.7% (79)
6–10	11.4% (38)
10+	9.9% (33)

Table 1: Percentage of patients with missing teeth.

Fig. 4 shows the gradual loss of functional units, defined as pairs of teeth in contact, over the years. The reader should be aware that reduced functional units do not necessarily signify missing teeth. Open bites are significant contributors to less functional units. We can observe this in this sample, within the 20–29 years old age bracket where we observed that a number of patients presented with anterior open bites, underscoring the need for orthodontic treatment.

There is an evident decline of all functional units (teeth in occlusion) from 40 years onwards. With only the average of number of functional units in the 70+ age group amounting to only 6.11 (of which only 3 are posterior). This shows a significant reduction in masticatory efficiency with age.

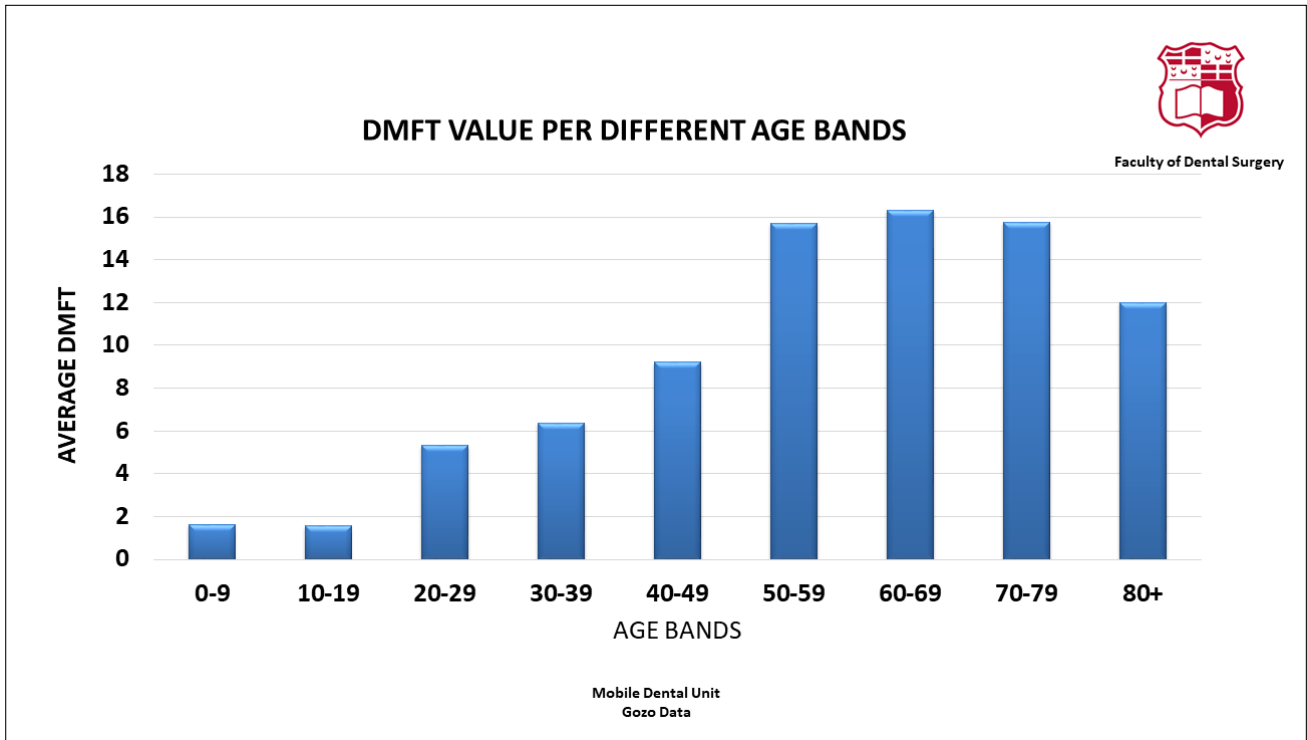


Figure 1: Average DMFT value for each age band in the Gozitan population.

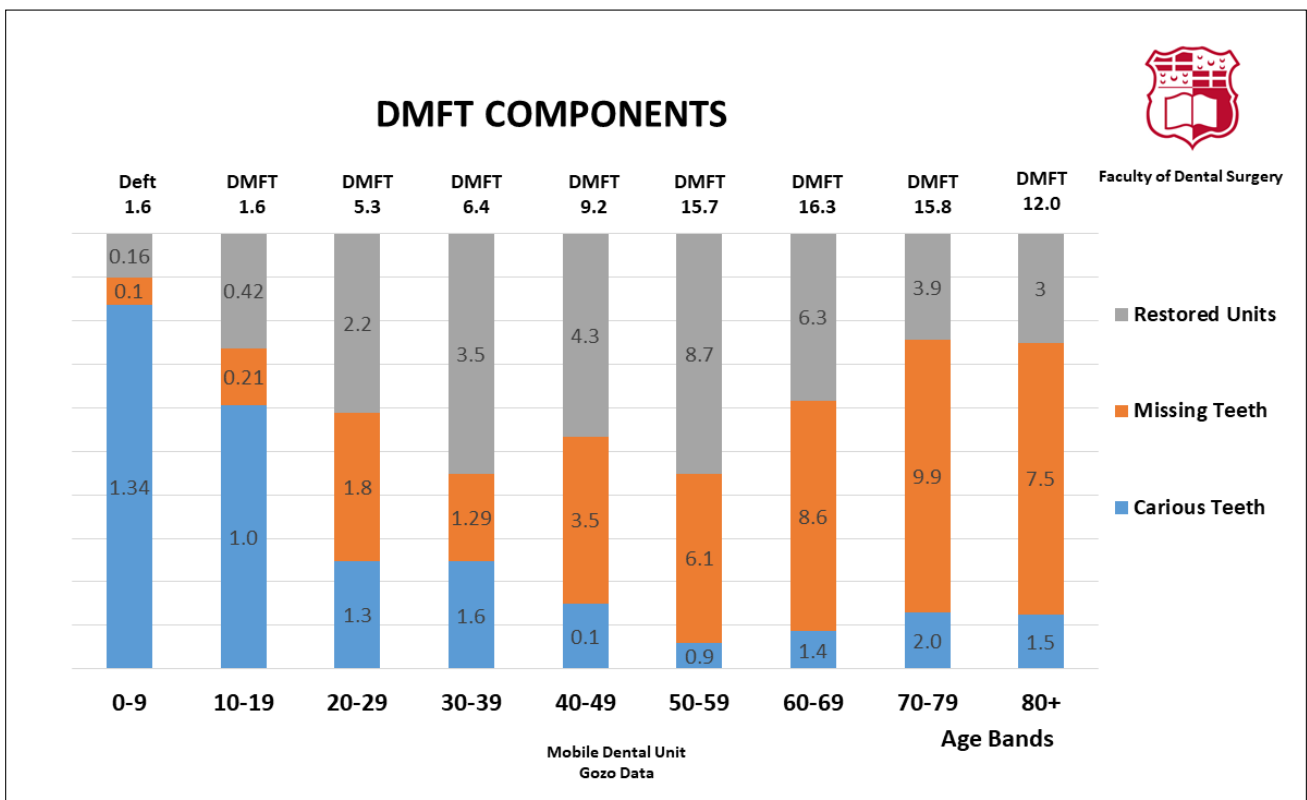


Figure 2: DMFT (decayed, missing and filled – teeth) components for each age band of the participants.

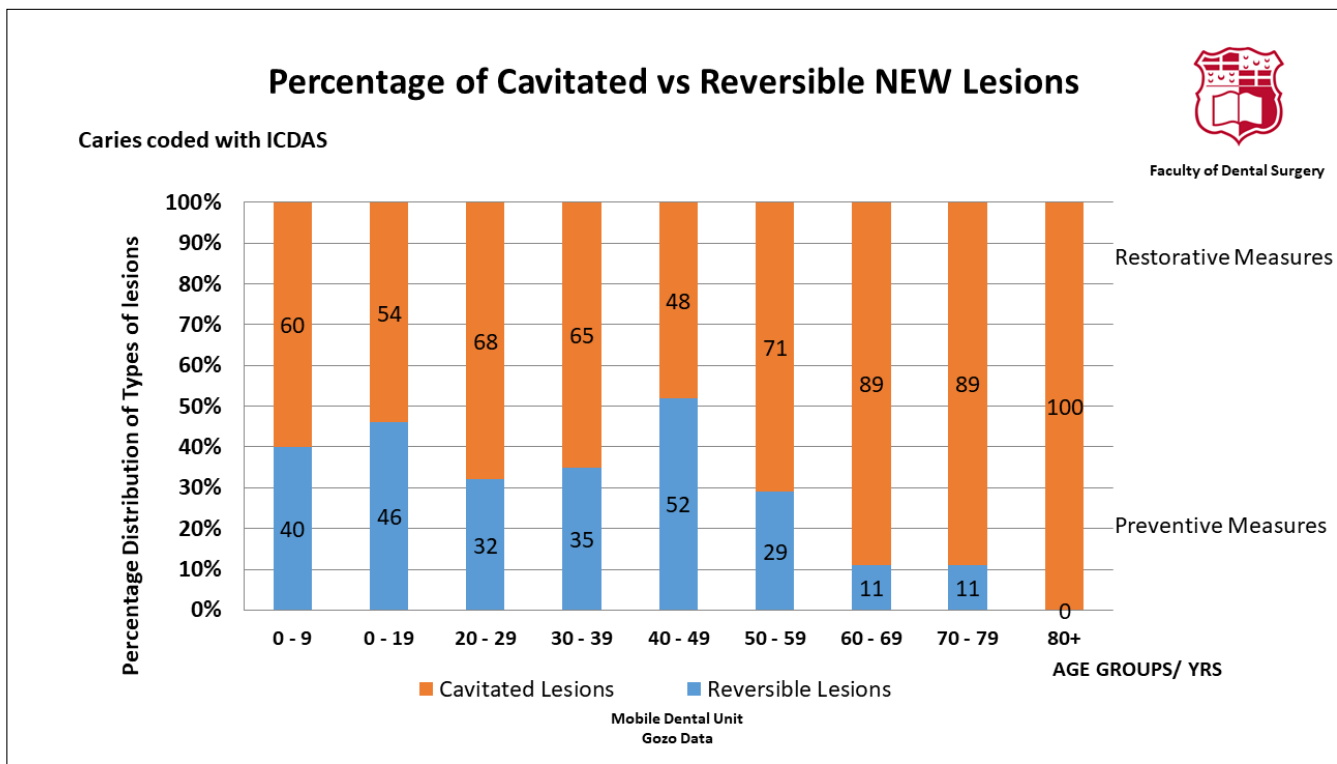


Figure 3: Percentage of cavitated and reversible new carious lesions.

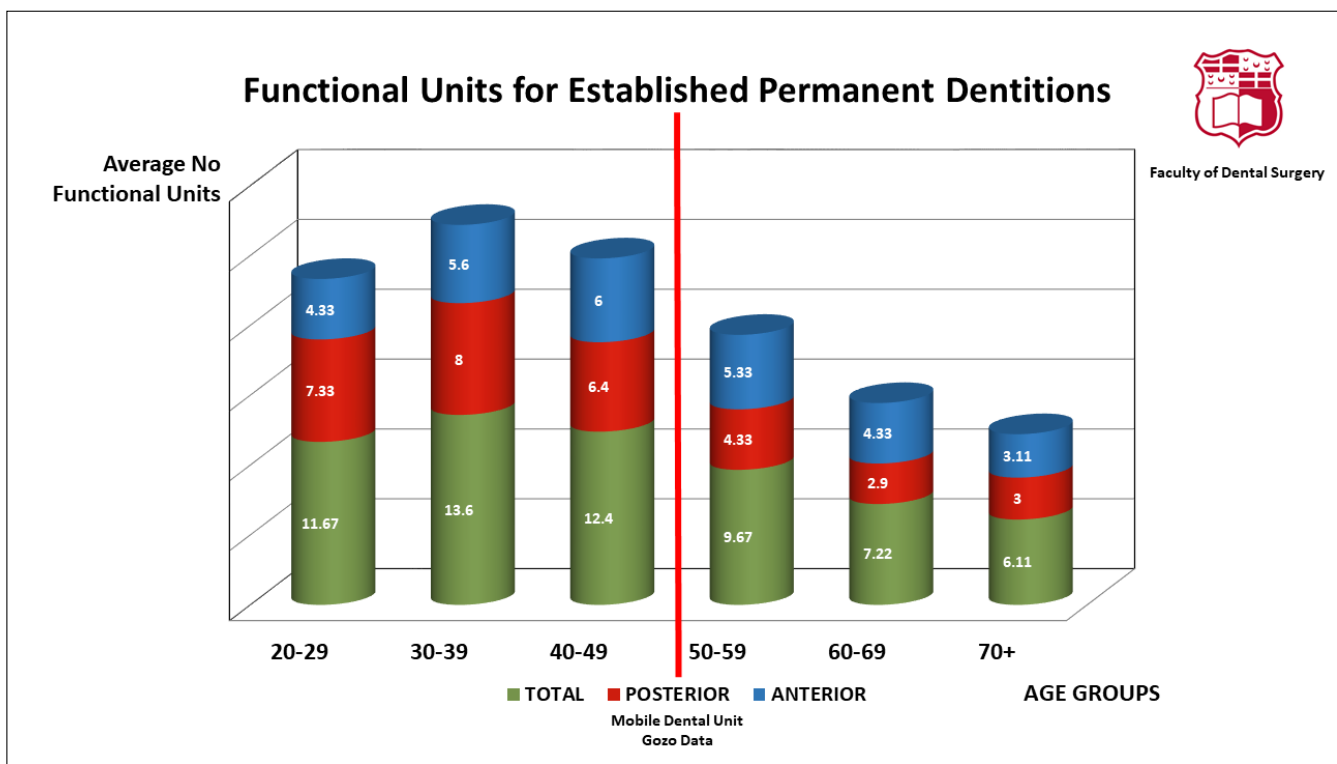


Figure 4: Average number of functional units per age band (anterior, posterior and total).

3.6 Erosion

Fig. 5 presents the erosive tooth wear, as measured with the BEWE index. It can be observed that erosion increases with age. 28% of the participants screened exhibited signs of erosive wear. Interestingly 21% ($N = 39$) presented with BEWE scores ≥ 9 , (signifying a need for restorative treatment) of which 64% ($N = 25$) had a maximum BEWE score of 18.

3.7 Treatment Needs

Of all the participants screened, 78% required non-urgent treatment (which includes periodontal or non-urgent restorative treatment), 19% required routine maintenance (routine check-ups and oral hygiene instructions) and 3% required urgent care. The latter were immediately referred for emergency treatment at Gozo General Hospital or Mater Dei Hospital.

4 Discussion

The aim of this outreach exercise, as mentioned previously, was to research the oral health status of Gozitan residents. Upon assessing Gozo as a community when compared to Malta, the social determinants of health such as income, education, social capital and occupation may not be very different to those of the mainland population. However, other social determinants such as the community structure and availability of health services, and larger forces such as structural inequality, cultural beliefs and attitudes may be different and may be interacting with choices in individual risk behaviours, environmental exposures and perceived access to health resources (David et al., 2006). This is being reflected as a reduced level of oral health for this population in the findings of this study.

Although the sample of participants in our study is not randomised, (it is described as a convenience sample due to the fact that whoever was interested in a dental check-up was recruited), the information gathered still has enormous ramifications. Keeping in mind Malta's own oral health goals for its population for 2020 (Department of Health Promotion and Disease Prevention, 2010), these results indicate that the oral health status in Gozo is lacking and is not reaching the goals described. To be able to reach any conclusions, however, other (randomised) studies need to be conducted.

Moreover, it is pertinent to presume that the participants who actually attended for the said check-up are the ones who are interested enough in their oral health to do so. So, although these results cannot be generalised to the whole Gozitan population, one might suggest that the oral health of the general population might actually be worse.

4.1 Oral Hygiene Habits

76% of the participants screened had plaque on their teeth at presentation. This means that their oral hy-

giene routine is not completely effective – a result of days of ineffective tooth brushing. Moreover, almost two thirds presented with calculus on their teeth – mineralised plaque after weeks of ineffective removal. This shows that the majority of participants and indeed the population still do not brush their teeth frequently or effectively enough.

4.2 DMFT

The results obtained indicate that despite having a lower DMFT value in the younger age groups, there is also a low level of restorative care resulting in a high level of untreated decay. Such a scenario leads to the presence of several open cavities in a child's mouth leading to the possibility of pain, infection and interferences/interruption of normal daily activities including eating, playing, sleeping and school attendance. The presence of untreated decay is also associated with a high oral bacterial count (Alaluusua, Kleemola-Kujala, Nystrom, Evalahti & Gronroos, 1987). This leads to an increased susceptibility to further or new decay in the same mouth. Restorative care returns the patient to a healthier, more fibrous diet, better function and the relief of pain and infection besides reducing the risk of further decay.

A large number of carious lesions were found to be at the reversible stage of the carious process. Such lesions are amenable to preventive measures that would arrest the lesions preventing cavitation. Timely preventive intervention, improved oral hygiene measures and dietary habits in all these cases avoid the need for more invasive and costly restorative intervention. Besides the economic cost in terms of direct cost, one should consider all indirect costs in order to provide and maintain the restorations for life, as well as the biologic costs.

In the 0–9 age band, caries is seen to be dealt with by restorations or extractions in equal frequency. Extractions at this age are probably of primary teeth. This leads to forward migration of adjacent posterior teeth leading to space loss and to disorders of occlusion necessitating orthodontic intervention at a later date.

With increasing age, the data illustrates that the choice of treatment for tooth decay was predominantly extraction rather than restorative care. This might also be a reflection of clinical decisions taken by dental surgeons who might still be favouring extractions rather than restorative treatment for carious teeth. The removal of teeth is not the end of dental problems but rather is the initiator of further complications. Tooth loss allows for the migration of adjacent teeth and over-eruption of opposing teeth resulting in a disruption of occlusion.

Furthermore, it leads to the ongoing and cumulative process of residual ridge resorption (Tallgren, 1972,

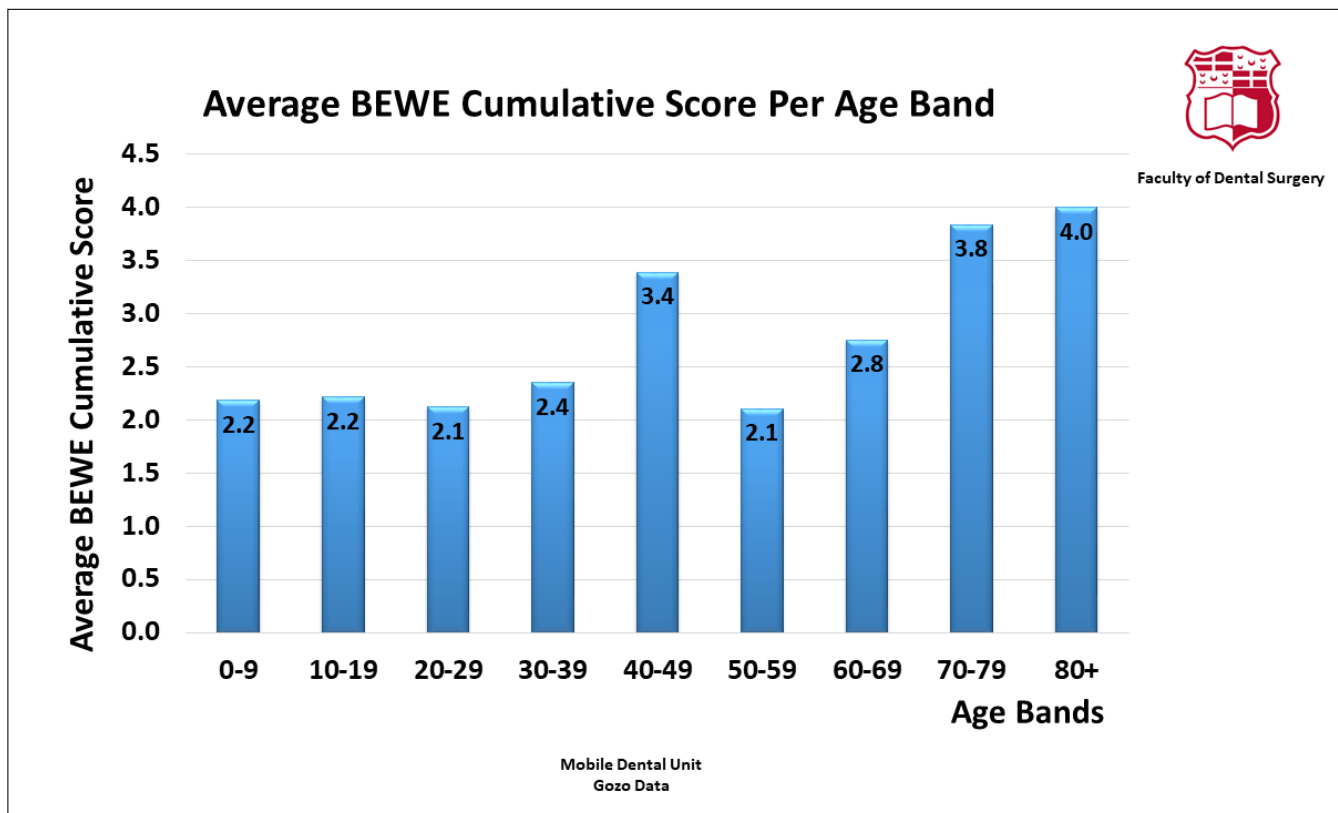


Figure 5: Tooth wear (erosion) scores per age bracket.

2003) which is further compounded in the older adults by frailty, illnesses and reduced capability to adapt to new dentures. All these factors result in the patients becoming prosthetically maladaptive due to a reduced capacity to adapt to full dentures. Chewing performance decreases, with a decline in the number of teeth present affecting the choice of food, with preference for soft food rich in saturated fats and cholesterol whilst avoiding food rich in dietary fibre (Brodeur, Laurin, Vallee & Lachapelle, 1993). Recent evidence also suggests that tooth loss was independently associated with the physical and cognitive decline in older adults. It was proposed that tooth loss is a potential early marker of decline in older ages (Tsakos, Watt, Rouxel, de Oliveira & Demakakos, 2015).

4.3 Functional Units and Anterior Open Bites

It was not determined why so many anterior open bites were encountered. This could be because the patients decided not pursue treatment at an earlier stage, they lacked awareness of their need or possibly they were not aware that orthodontic treatment is offered for free for individuals under 16 years of age.

4.4 Care Index

This would be calculated as the number of restored (filled) teeth divided by the whole DMFT value. The

care index value was found to be low throughout all age groups. Overall, it was found to be 37% whilst in the 10–19 year age band this amounted to 33% - a far cry from the 70% target for Malta in 2020 (Department of Health Promotion and Disease Prevention, 2010). In fact, a glance at these treatment needs shows that most of the participants screened needed to be referred for treatment, some even urgently.

This shows that most caries is being left untreated, especially in younger age groups. This is also true in the 70+ age groups where most teeth were either decayed or extracted teeth rather than restored.

To expand even further on this point, there were almost half the participants with missing teeth (48%) with older cohorts (60+) having on average less than 10 functional units in total, with those who are 70+ having an average of 6. This is less than the 10 functional units (20 teeth in occlusion) recommended by the WHO (Petersen, 2009) for adequate mastication and a good quality of life.

4.5 Erosion

This type of tooth wear has become an increasing concern in the Maltese population, especially in preschool and school children. Recent studies also reported this

erosive wear to be significantly associated with an increased consumption of carbonated drinks, flavoured water and packaged juices (Gatt et al., 2017; Schembri & Attard, 2017).

4.6 Reversible Versus Irreversible Carious Lesions

The index used to measure caries during the study was the ICDAS which allows for an easy distinction between reversible (re-mineralizable) carious lesions - needing only preventive interventions, and irreversible carious lesions which would have progressed to a stage where restorative treatment is needed. As seen in Fig. 3, a high percentage of diagnosed lesions, especially in the younger age groups, were at the reversible stage. This highlights two points, namely: the importance/relevance of preventive interventions especially in younger age groups and the importance of early screening for early diagnosis due to the distinct visible gradual progress of carious lesions.

Another peak was seen in the 40–49 age band. This result was quite unexpected as usually in adults and older age groups the carious process occurs at a much slower rate. This could be due to the poor oral hygiene found in most participants putting even adults in a high-risk category with incipient caries lesions (usually common in children and teens) emerging even later in adulthood.

This emphasizes the importance of focusing on prevention. In dentistry, prevention would include dietary counselling, the promotion of effective tooth brushing with fluoride-containing toothpaste and other oral hygiene products, and the placement of fluoride varnishes and/or fissure sealants by dental professionals.

5 Conclusion

Basic principles for improving dental public health and preventing diseases include focusing on social determinants of health (Marmot & Bell, 2011; Tellez, Zini & Estupiñan-Day, 2014). Focusing on individuals and education alone is ineffective long term. The idea is to change the environment surrounding people making it conducive to health (Watt, 2005). Improvements in social determinants such as economic and educational status, housing and policies that promote oral health all bring about long-term improvements in health in general (Watt, 2005; Watt & Sheiham, 2012).

When taking Malta's health profile into consideration, the country is in the spotlight for high obesity and diabetes prevalence rates (Cuschieri et al., 2016; Grech et al., 2017). These two morbid non-communicable diseases have an important risk factor that is common to dental caries - sugar (diet). It would therefore be desirable, and more effective to implement the Common Risk Factor Approach to prevent multiple diseases by

focusing on the common risk factor, in our case mainly sugar, and working with other professionals such as doctors, nutritionists, teachers etc. to bring about a decline in obesity and diabetes along with dental caries (Sheiham & Watt, 2000; Watt & Sheiham, 2012).

Even though this study's sample was not strictly randomised, the long-term implications of this cross-sectional survey are profound. It is prime time that the Gozitan community is provided with a targeted and enduring oral health programme with the aim of mitigating the findings of this study. It is recommended that 1) health services are reoriented to give more importance to early screening and prevention of dental diseases, 2) more hygienists are employed in Gozo to promote oral health and provide preventive interventions, including supervised school preventive interventions, 3) awareness of the accessibility and availability of dental health services in the population is increased and 4) the Common Risk Factor Approach is employed to promote health with particular focus on diet and smoking. Such a programme will address barriers to health care utilization that seem to be present and will leave Gozo with a more enduring oral health legacy.

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Road Courtesy: A Prerogative of Gender, Age and Car Size

Edward Attard-Montalto¹, Simon Attard-Montalto*²

¹Department of Computer Science, Bath University, Bath, United Kingdom

²Department of Paediatrics, Faculty of Medicine and Surgery, University of Malta, Msida, Malta

Abstract. This study addressed the hypothesis that courtesy on busy Maltese roads was dependent on, or influenced by, independent factors relating to the driver and car, or both. Courtesy was defined when a driver with the right of way ‘allowed access’ to another car onto a main road leading to a congested roundabout, whereby ‘courteous passage’ was the only reasonable means of access for the second car. ‘Allowed’ access to the same car (British Vehicle Classification [BVC] class 2, 17.5 years old in poor condition), with one driver aged 50+ and one passenger aged 17 years, approaching the same junction between 07:15 and 07:45 on school days was assessed. Details of all cars including BVC group that refused or allowed access, their drivers’ gender and age (± 10 years), any accompanying passengers and the prevailing weather was recorded onto a standardised proforma. Data from 88 schooldays over 6 months resulted in 141 refusals plus 44 courteous passes (analysed), and 46 access events through gaps in traffic (not analysed). The weather conditions and presence/absence of any co-passengers, whether adult or children, had no bearing on road courtesy. Courtesy was significantly enhanced with family saloons (BVC Groups 4–6) when compared with small cars (Group 1–3, $p = 0.04$), and luxury or work vehicles (Group 7–11, $p = 0.0065$), especially in those with male drivers aged 40+ ($p = 0.022$). Drivers of large and work vehicles, almost exclusively male (92%), were significantly less courteous ($p = 0.025$).

Keywords: Road courtesy, gender, car size

1 Introduction

Courtesy on roads is probably an important contributor to a pleasant driving experience and may encourage better driving and road safety. Conversely, it is clearly absent in extreme cases of road rage (SafeMo-

torist.com, 2016; DailyMail, 2015). Like road rage, road courtesy may be more prevalent in certain countries (Intelligence for Your Life, 2017) and in certain regions within countries and, amongst others, this may be a factor related to the local culture, population behaviour and educational level. Within Europe, for example, it is commonly accepted that the standard of driving and associated courtesy on the road is higher in northern countries and less so in southern and Mediterranean states. This may be a phenomenon linked with driving alone and may not translate to general courtesy ‘off the road’. Indeed, many non-European and southern European countries with a reputation for poor driving have a well-earned reputation for excellent hospitality, Malta included (MaltaUncovered.com, 2017; Greenfield, 2012). It is difficult to generalise results and behaviour may vary widely even within the same country, and when comparing one subpopulation with another. Variations in courtesy on the road was observed between different groups in Malta over a number of years and, at face value, appeared to be linked to specific characteristics of the drivers involved. Hence, for example, it was noted subjectively that drivers of large vehicles, buses, taxis and luxury cars appeared to be less courteous, and the same was observed for younger drivers and, to varying degrees, mothers on the school run. This study set out to explore the hypothesis that this observation was objectively reproducible and that courtesy was, indeed, associated with the driver and/or vehicle characteristics.

2 Methods

For the purposes of this study, courtesy was defined when a driver with the right of way on a main road leading up to a congested roundabout, ‘allowed access’ to another car approaching from a secondary feeder road, whereby ‘courteous passage’ was the only reasonable means of access for the ‘secondary’ car (i.e. there

*Correspondence to: Simon Attard-Montalto (simon.attard-montalto@gov.mt)

was no other facilitating option such as traffic light control). The scenario, road junction and the secondary car remained constant throughout the study. Courtesy afforded to the same 'secondary' study car, a 1.1 litre 1998-model Opel Corsa, British Vehicle Classification class 2 (Wikipedia, 2015a, 2015b; carhirecentre.co.uk, 2016), and 17.5 years old in poor condition, with the same driver (SAM, 50+ years) and one passenger (EAM, 17 years), approaching the same junction from the same secondary road between 07:15 and 07:45 on school days was assessed. Care was taken by both driver and passenger in the study car not to coerce or attempt to influence the approaching driver on the primary road in allowing access. 'Events' involving any driver that was known to (and recognised) either EAM or SAM were excluded from the analysis. Details of all cars on the primary road (and, therefore, with the right of way) that refused/allowed access to the secondary car, were recorded by EAM on a standardised proforma. This included the car type and model, grouped according to the BVC. The drivers' gender and age were also recorded, the latter estimated by agreed consensus by both EAM and SAM, and categorised into six age-groups incremented in blocks of 10 years from < 20, 20–29, 30–39, . . . to > 60 years). Finally, the presence of any passengers (by number, adult or children), and the prevailing weather, categorised into sunny, cloudy or rainy, according to the official meteorological daily report were noted.

The study was carried out on Monday to Fridays over the school semesters spanning autumn 2014 to spring 2015. Weekends, school holidays and any days when EAM was not a passenger in the study car at the designated journey time were excluded. Study days were noted and dated at the start of the journey on a hand held clip-chart by EAM and the inclement weather recorded. A pilot test run was first carried out using the identical study scenario over one week. This confirmed that all the above details could not be recorded and memorised accurately in the event of fast flowing traffic. As a result, the method was altered such that, once the study car was positioned at the appropriate junction in the front of the queue awaiting courteous access, all cars that drove past refusing access as well as the first car that allowed access were recorded discretely by EAM using a mobile phone video. Once afforded access, this video was stopped and played back by EAM to extract details required for completion of the proforma. Once completed, the video was permanently deleted. This process was found to be feasible in practice, and adopted for the rest of the study.

Data was transferred onto an excel spreadsheet with refusals and allowed access 'events' compared with car type, driver (age and gender), presence or otherwise of accompanying passengers, and weather. The Chi

Squared test was used to identify significant associations between the categorical variables and Fisher correction was used to account for small frequencies. Moreover, a 0.05 level of significance was adopted and taken to assess statistical significance.

3 Results

Data obtained from 88 schooldays over a 6 month period resulted in 231 study events. These included 141 refusals by individuals unknown to the driver, 48 courteous passes (but only 44 were analysed as 4 drivers recognised SAM and were discounted). An additional 42 access events arose through gaps in the traffic and were not included in the analysis, leaving a total of 185 analysable 'events'.

Up to 89 male drivers in all car groups refused access whilst 24 afforded courteous passage, compared with 53 refusals and 19 'passes' by female drivers, ($\chi^2(1) = 0.65$, $p = 0.42$). Similarly, weather conditions had no bearing on road courtesy, with 40 refusals versus 15 passes during sunny days, 26 versus 8 on cloudy days and 75 versus 21 on rainy days, respectively ($\chi^2(2) = 0.56$, $p = 0.76$). Of the 185 analysed 'events', 143 involved a solo driver whereas 42 had one or more co-passengers in the primary vehicle (25 children, 17 adults). The presence or absence of any co-passengers had no bearing on courtesy as 35 of 143 solo drivers, 6 of 25 with children and just 4 of 17 with adult co-passengers afforded courteous passage ($\chi^2(2) = 0.009$, $p = 0.99$).

Upon analysing courtesy with the type of vehicle, from a total of 48 driving medium-sized saloons (British Vehicle Classification Groups 4–6), courtesy was afforded by 18 drivers compared with 30 who did not, whilst of 101 drivers in small cars (Group 1–3), 22 gave way and 79 refused ($\chi^2(1) = 4.1$, $p = 0.043$). Similarly, 18 from 48 cars in Groups 4–6 afforded access compared with just 4 from 36 luxury or work vehicles in Groups 7–11 ($\chi^2(1) = 7.41$, $p = 0.0065$). This difference was highlighted if cars in Groups 4–6 were compared with those in both small (Groups 1–3) and luxury/large/work categories together (Group 7–11): 18 from 48 allowed access versus 26 from 137, respectively ($\chi^2(2) = 6.72$, $p = 0.0095$).

The drivers' age alone did not determine the likelihood of being courteous as defined in this study, with 32 from 104 drivers aged over 40 allowing access, compared with 17 from 81 younger drivers ($\chi^2(1) = 2.23$, $p = 0.14$). However, if the driver's age was combined with both gender and car type, male drivers aged above 40 years driving medium sized cars (Groups 4–6) were significantly more courteous than all other groups. Indeed, 10 males from a total of 24 aged 40+ driving medium sized cars (Groups 4–6) showed courtesy, compared with 33 from 89 who did not ($\chi^2(1) = 5.25$, $p = 0.022$).

Drivers of large and work vehicles, mostly male (92%), were significantly less courteous with just 2 from 28 drivers showing courtesy versus 40 from 149 drivers in smaller vehicles ($\chi^2(1) = 5.06$, $p = 0.025$).

4 Discussion

This study confirms objectively the previously subjective impression that, in Malta, some drivers are more courteous than others. The study design whereby the scenario, location and secondary car were kept constant allowed for a reasonable comparison. The key finding that males over 40 years driving family saloons were the most courteous, whilst luxury car, truck and van drivers were the least likely to afford courteous access, was in line with the previous subjective personal experience of the driver (SAM). The study was performed for a limited period during school days and did not trawl enough female drivers to demonstrate any association between this subgroup and road courtesy. Driver age was ‘estimated visually’ to the nearest decade by two independent observers but errors may still have arisen in this regard, and a broader categorisation into ‘young’ or ‘middle-aged adult’ or ‘senior citizen’ may have been more practical. Likewise, the study was statistically underpowered to show any association with taxis and buses, and there was insufficient data to demonstrate any association between heightened or diminished courtesy and the prevailing weather. The latter is a clear determinant in road accidents (Perrels, Votsis, Nurmi & Pilli-Sihvola, 2015; Bergel-Hayat, Debbarh, Antoniou & Yannis, 2013) and, given that weather may affect driver mood, may influence the likelihood of courtesy, or otherwise. Finally, the presence of any co-passengers also had no bearing on courtesy afforded by the drivers involved.

This study has confirmed an interesting observation but is limited by the relatively small number of events analysed and possible bias (for and against) a middle-aged driver with one teenage passenger in a beat up small car. Indeed, the results may have changed significantly with the same scenario but with a driver in his (or her) 20s and, likewise, may have changed again if the ‘decoy secondary car’ was new and ‘flashy’. A far larger study utilising a similar ‘set’ scenario but with different ‘decoy’ secondary car-driver combinations may demonstrate widely different courteous attitudes between different groups e.g. young male in sports car toward older women in SUV, male taxi driver toward elderly gentleman in a small car, etc. The relative age of the cars involved was not recorded and this may have had a bearing on the results, which may have shown that drivers of newer cars would tend to be more courteous. Different results may have been observed if an identical study was carried out in the afternoon rather than in the height of the morning rush hour, when drivers may be more re-

laxed and more courteous. The possible combinations are numerous but this study would require a very large number of car-encounters to identify any particular patterns of courteous behaviour.

Interestingly, would the result obtained have been different if the study was conducted in a different location on the island? Given the same scenario, would drivers from one part of the island afford more or less courtesy than others? Again, this question can only be answered by means of a larger, longer study run over several locations. Although blinded to the study, participants did not give consent (although this itself would have negated the impartiality of their behaviour), and unwittingly, may have been influenced by subtle changes in facial expressions and body language of the authors. Ideally, therefore, any future study should deploy covert independent observers outside the cars involved to exclude bias in this regard.

How does Malta compare with other countries in regards to courtesy on the road? This is a difficult question to answer as there is no data from comparable studies performed in other countries, and very little reference to road courtesy whatsoever, other than in general ‘common-sense’ articles (Jackson, 2012). MaltaUncovered.com (2017) lists “hot-headed and ignorant drivers” as the third biggest challenge to driving experience in Malta. Although this study does not support or refute this bold and rather negative generalisation, it also suggests a lack of courtesy on Malta’s roads. In this regard, in contrast to Malta’s general reputation for friendliness and hospitality, there appears to be room for improvement.

5 Conclusion

This study has shown that courtesy on Maltese roads does vary according to who is behind the wheel and what car is being driven. Certainly, middle-aged gentlemen driving rather tired old cars can expect to be allowed access even when they don’t have the right of way by similarly aged males in family saloons, but have little hope if confronted by larger, work or luxury car drivers.

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Examining the Structural Validity of the Strengths and Difficulties Questionnaire (SDQ) in a Multilevel Framework

Lara Marie Azzopardi¹, Liberato Camilleri^{*1}, Fiona Sammut¹ and Carmel Cefai²

¹Department of Statistics and Operations Research, University of Malta, Msida, Malta

²Department of Psychology, University of Malta, Msida, Malta

Abstract. The Strengths and Difficulties Questionnaire (SDQ), proposed by Goodman (1997), has been used by many researchers to measure the social, emotional and behaviour difficulties in children. The SDQ comprises four difficulty subscales measuring emotional, conduct, hyperactivity and peer problems. It also includes a fifth subscale measuring prosocial behaviour. A sample of 5200 Maltese students who were aged between 6 and 16 years was used to investigate the multilevel factor structure underlying the teachers' version of the SDQ. Statistical analysis in this study was conducted using Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), Structural Equation Modelling (SEM) and Multilevel Structural Equation Modelling (MSEM). The study finds that a two-level three-factor model fits the data marginally better than a single-level three-factor model.

Keywords: Social emotional and behaviour difficulties (SEBD), Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), Structural Equation Modelling (SEM), Multilevel Structural Equation Modelling (MSEM)

Abbreviations

Adjusted Goodness-of-Fit Index (AGFI), Comparative Fit Index (CFI), Goodness of Fit Index (GFI), Incremental Fit Index (IFI), Linear Structural Relations (LISREL), Kaiser Meyer Olkin (KMO), Modification Index (MI), Multiple Indicators and Multiple Causes (MIMIC), Multilevel Modelling (MLM), Normed Fit Index (NFI), Non-Normed Fit Index (NNFI), Pre-processor for LISREL (PRELIS), Principal Component Analysis (PCA), Relative Fit Index (RFI), Root Mean Square Error of Approximation (RMSEA), Strengths

and Difficulties Questionnaire (SDQ), Weighted Least Squares Estimation (WLS), Parameter Estimate (Est.), Standard Error (S.E.).

1 Introduction

The SDQ, proposed by Goodman (1997), is a screening tool which is able to identify the prevalence of social, emotional and behaviour difficulties (SEBD) amongst children. The SDQ consists of five subscales that measure emotional, conduct, hyperactivity and peer problems together with prosocial behaviour. In turn, every subscale has five items all measured on a 3-point scale ranging from 0 to 2, where 0 corresponds to 'Not True', 1 to 'Somewhat True' and 2 corresponds to 'Certainly True'. Five of the items are negatively worded and require reverse-coding to generate the subscale scores, which range from 0 to 10. The total difficulty score, which excludes the prosocial subscale, ranges from 0 to 40. There exist three versions of the SDQ; one which is administered by the teacher, one by the parent and the other is self-administered by the student. These three SDQ versions have been translated into several languages, including Maltese. Cefai, Cooper and Camilleri (2008) validated the Maltese SDQ version through a process of forward and backward translations from English to Maltese. The reliability of the Maltese SDQ version was measured item by item where correlations ranged from 0.82 to 0.98.

2 Theoretical Framework

The main objective of this study is to analyse the factor structure underlying the rating scores provided to the 25 SDQ items by employing *Multilevel Structural Equation Modelling* (MSEM) which combines *Multilevel Modelling* (MLM) with *Structural Equation Modelling* (SEM).

Multilevel models (MLM) accommodate both fixed

*Correspondence to: Liberato Camilleri (liberato.camilleri@um.edu.mt)

and random effects. Consequently, these models are appropriate to analyse clustered data that has a hierarchical nested structure. Multilevel models assume an error distribution at each level of nesting. With this modelling framework, it is possible to separate the observed variance within-clusters from the between-clusters components. On the other hand, the Structural Equation Modelling is a method which consists of three main analyses: Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA) and Structural Equation Modelling (SEM). The EFA accounts for patterns of correlations existing between the observable variables in terms of smaller number of latent variables. Once the EFA determines the factor structure, the CFA model is then fitted to the dataset to verify the pattern of the factor loadings, the number of the underlying factors and any covariances existing amongst the factors. Then, once the CFA confirms the latent structure, the SEM model is refitted to the data to analyse the relationships existing amongst the latent variables. SEM is made up of a measurement model and a structural model. A measurement model defines the latent constructs utilising various observable variables while a structural model assigns relationships between the latent variables.

In the presence of hierarchically nested data, Multilevel Structural Equation Modelling (MSEM) enables the researcher to fit either a CFA or SEM model at every nesting level of the hierarchical structure. This technique can be implemented by either starting with the MLM or the SEM analysis. In this paper, the statistical software Mplus (version 6) was used to analyse the data through MSEM. Mplus is statistical software which was developed by L. K. Múthen and Múthen (1998–2011). It is important to note that the MSEM methodology implemented by Mplus can only accommodate a two-level nesting structure. Consequently, in this analysis, a two-level model is fitted, where students (Level 1) are nested in classes (Level 2).

2.1 Model Specification of Two-level Factor Structure

Similarly to SEM, the multilevel structural equation model consists of the measurement model and the structural model. Additionally, the MSEM adjusts for the nested levels within the data by specifying a measurement model at each level and simultaneously enables the separation of the total variance into the within-group variance and the between-group variance. Rabe-Hesketh, Skrondal and Pickles (2004) defines a two-level SEM model as ‘the specification of hierarchical conditional relationships. The response model specifies the distribution on the observed responses conditional on the latent variables and covariates (through a linear predictor and link function) and in the structural model the

latent variables themselves may be regressed in other latent and observed covariates’.

The model specification of the two-level factor analysis follows the specification of Múthen’s (1984, 1991, and 1994) work. This two-level confirmatory factor analysis decomposes the variability belonging to the indicators into the individual variability (within-level) and the between variability (between-level). This specification can be used with binary, ordinal categorical variables, censored, continuous responses or a combination of all. In this paper, this model assumes a two-level data structure existing with N statistical units (which in this dataset are students) which are in turn clustered in J groups (which in this dataset are classes). In this paper, it is assumed that the vector of the teachers’ response can be decomposed into the sum of the within and between-class components.

Let \mathbf{y}_{ij} be the vector of the teacher’s SDQ responses about student i attending class j . By following Múthen’s (1984) procedure, the model is constructed by defining an underlying normal distribution to the latent variable $\mathbf{y}_{p_{ij}}^*$ for the p^{th} observed variable $\mathbf{y}_{p_{ij}}$. Since the dataset consists of ordinal variables, this latent variable is defined by a set of thresholds. The vector of responses is illustrated as

$$\mathbf{y}_{ij}^* = \mathbf{y}_{B_g}^* + \mathbf{y}_{W_g}^*, \quad (1)$$

where $\mathbf{y}_{B_g}^*$ is the between-class contribution to the teachers’ responses and $\mathbf{y}_{W_g}^*$ is the within-class contribution to the teachers’ responses. Hence the total population covariance matrix (Σ_T) can be decomposed into a between-class population covariance matrix (Σ_B) and a within-class population covariance matrix (Σ_W). Consequently,

$$\Sigma_T = \Sigma_W + \Sigma_B. \quad (2)$$

Furthermore, it follows that

$$\Sigma_W = \Lambda_W \Phi_W \Lambda_W' + \Theta_W, \quad (3)$$

and

$$\Sigma_B = \Lambda_B \Phi_B \Lambda_B' + \Theta_B, \quad (4)$$

where Φ_W and Φ_B represent the covariance matrix for the within and the between-class factors. Moreover, Θ_W and Θ_B represent the covariance matrix for the diagonal matrices of the within and the between-class unique variance respectively.

2.2 The Two-level Measurement Model

Following Múthen’s (1991) model, the model specification of the Level-1 (within-model) is defined as

$$\mathbf{y}_{ijk} = \alpha_{jk} + \lambda_{W_k} \eta_{W_{ij}} + \varepsilon_{W_{ijk}}, \quad (5)$$

where \mathbf{y}_{ijk} represents the teacher’s observed score on the indicator variable k given to student i attending class j ;

α_{jk} represents the intercept of indicator variable k in class j ; λ_{W_k} represents the within-level factor loading λ_W of the indicator variable k ; $\eta_{W_{ij}}$ represents the score given by the teacher of student i attending class j on the within-level latent η_W ; $\varepsilon_{W_{ijk}}$ represents the within-level error term, for the teacher of student i attending class j on the indicator variable k . Furthermore, the model specification of the Level-2 (between-model) is expressed as

$$\alpha_{jk} = \nu_k + \lambda_{B_k} \eta_{B_j} + \varepsilon_{B_{jk}}, \quad (6)$$

where ν_k represents the class-grand intercept of indicator variable k , which is the grand mean when the between-level latent variable is 0; λ_{B_k} refers to the between-level factor loadings of the indicator variable and η_{B_j} refers to the score of class j on the between-level latent variable η_B ; $\varepsilon_{B_{jk}}$ refers to the between-level error term ε_B for class j on the indicator variable k . Consequently, one can deduce that

$$y_{ijk} = \nu_k + \lambda_{B_k} \eta_{B_j} + \varepsilon_{B_{jk}} + \lambda_{W_k} \eta_{W_{ij}} + \varepsilon_{W_{ijk}}. \quad (7)$$

The term α_{jk} which is the class-specific item for the indicator variable k on the within-level is at the same time a dependent variable at the between-level (class-level). Consequently, this shows that the variability of class specific intercepts of an indicator variable k can be explained in the between-level by means of the latent variable η_{B_j} . The non-explained variability in α_{jk} is captured by the class-error term represented by $\varepsilon_{B_{jk}}$.

2.3 The Two-level Latent Variable Model

The latent variable model of Level-1 can be represented by

$$\eta_{W_{ij}} = \mathbf{B}_W \eta_{W_{ij}} + \mathbf{\Gamma}_W \mathbf{X}_{W_{ij}} + \zeta_{W_{ij}}. \quad (8)$$

$\mathbf{X}_{W_{ij}}$ consists of the vector of observed explanatory variables at the within-level; \mathbf{B}_W consists of coefficient matrices between the latent and observed variables existing at the within-level; $\mathbf{\Gamma}_W$ consists of the vector of measurement intercepts at the within-level and $\zeta_{W_{ij}}$ consists of the vector of disturbances at the within-level which are independent and randomly distributed with a zero mean and full variance-covariance matrix Θ_W and Ψ_W . Moreover, the latent variable model of Level-2 can be represented by

$$\eta_{B_j} = \alpha_B + \mathbf{B}_B \eta_{B_j} + \mathbf{\Gamma}_B \mathbf{X}_{B_j} + \zeta_{B_j}. \quad (9)$$

α_B represents the class specific intercepts at the between levels; \mathbf{X}_{B_j} consists of the vector of observed explanatory variables at the between-level; \mathbf{B}_B consists of coefficient matrices between the latent and observed variables existing at the between-level; $\mathbf{\Gamma}_B$ consists of the vector of measurement intercepts at the between-level and ζ_{B_j} consists of the vector of disturbances at the

between-level which are independent and randomly distributed with mean 0 and full variance-covariance matrix Θ_B and Ψ_B .

3 Methodology

In this study, a random sample of 1326 teachers was selected from 110 schools, of which 66 were primary schools and 44 were secondary schools in order to analyse the social emotional and behaviour difficulties of 5200 students utilising the teacher SDQ version. Furthermore, the random sample, which was collected in 2005–2006, includes approximately 7% of the whole Maltese student population aged 6 to 16 years. In order to guarantee a representative sample, the students were stratified by gender, school-level, school-type and school region. The teachers were asked to assess the children they supervised by rating each of the 25 items of the Maltese SDQ teacher version. These items were measured on a 3-point scale ranging from 0 to 2 (not true, somewhat true and certainly true). The five items associated with emotional difficulties assessed anxiety, depression, fear and unhappiness. On the other hand, the five items associated with hyperactivity assessed restlessness, inattention, distraction, over-activity and inability to finish work. The five items associated with conduct problems assessed ill-temper and behaviour problems such as fighting, cheating, lying and stealing. The five items associated with peer problems assessed poor relations with peers, bullying and loneliness and the five items related to prosocial behaviour assessed good qualities like considerate, helpful, caring and kind to others. The scores of these five subscales were generated after reverse-coding the five negatively worded items.

4 Data Analysis and Results

The aim of this paper is to confirm whether or not a two-level three-factor model fits adequately the teachers' SDQ data collected in 2005–2006. Exploratory Factor Analysis, Confirmatory Factor Analysis, Structural Equation Modelling and Multilevel Structural Equation Modelling are utilised to identify the best model fit. EFA was carried out using SPSS software while CFA and SEM were carried out using LISREL (version 8.80) software. Furthermore, Mplus (version 6) statistical software was used to fit a two-level three-factor CFA model and a two-level three-factor SEM model for this SEBD dataset. The LISREL (version 8.80) software is not appropriate to fit a two-level CFA/SEM model because it accommodates continuous responses but not ordinally-scaled categorical responses.

4.1 Internal Consistency

Cronbach Alpha (Cronbach, 1951) was utilised to assess the internal consistency of the items within every subscale. The items in the Conduct, Hyperactivity, Emo-

tional and Prosocial subscales have satisfactory internal consistency and their Cronbach Alpha exceeded the 0.7 threshold values. The Peer subscale had a weak internal consistency, since its Cronbach Alpha just exceeded the 0.5 threshold. The item *Child gets on better with adults than children of same age* was weakly related to other items in this subscale.

4.2 Exploratory Factor Analysis

Exploratory Factor Analysis was used to assess the factorial validity of the whole SEBD data and to identify the number of latent dimensions underlying this dataset. The Kaiser Meyer Olkin (KMO) value, which gives an indication of the relative compactness of the correlations, was found to be equal to 0.898, which exceeds the 0.5 threshold value. Moreover, the Bartlett's test of sphericity, which tests whether the correlation matrix is significantly different from the identity matrix, yielded a *p*-value less than the 0.05 level of significance. Both results indicate a latent structure within this SEBD data and that EFA is essential to reveal the latent factor structure.

Table 1 displays the factor loadings of this three-factor model. Stevens (2002) suggested a threshold value of 0.4 for these factor loadings when the sample size exceeds 150 observations and the number of variables exceeds 10. Factor 1, which represents the Externalisation dimension, comprises nine of the items in the Hyperactivity and Conduct subscales, including *Tempers*, *Obedient*, *Fights*, *Lies*, *Restless*, *Distractible*, *Fidgety*, *Reflective* and *Persistent*. Moreover, Factor 2, which comprises all the items in Prosocial subscale, includes *Considerate*, *Shares*, *Caring*, *Kind to kids* and *Helps out*. Furthermore, Factor 3, which represents the Internalisation dimension, comprises six of the items in the Emotion and Peer subscales, including *Worries*, *Unhappy*, *Clingy*, *Fears*, *Solitary* and *Bullied*.

4.3 Confirmatory Factor Analysis (CFA)

A three-factor CFA model was then fitted to the whole SEBD sample using the Weighted least squares (WLS) estimation technique. This is the appropriate estimation technique when analysing ordinal categorical responses (rating scores). The fitted model defines the relationships amongst the Externalisation, Prosocial and Internalisation dimension while relaxing some of the assumptions posed in EFA. Once a model was specified, the *t*-rule was used to assess whether the model is identified. Since the *t*-value for the model fit was found to be 45, which is less than the $0.5q(q+1) = 210$ criterion, then the three-factor CFA model has model identification. The resulting parameter estimates of lambda-x, phi-paths and theta-deltas were all found to be significant since the corresponding z-scores exceed 1.96 for all observed variables.

Table 1: The factor loadings of 3 factors using Varimax Rotation.

Variable Description	Externalisation Factor	Prosocial Factor	Internalisation Factor
Tempers	0.54	0.20	0.08
Obedient	0.56	0.27	0.10
Fights	0.62	0.21	-0.01
Lies	0.55	0.27	0.09
Steals	0.22	0.12	0.11
Somatic	0.21	0.03	0.38
Worries	-0.04	-0.05	0.62
Unhappy	0.16	0.08	0.60
Clingy	0.12	0.06	0.60
Fears	-0.03	0.04	0.67
Restless	0.77	-0.04	-0.07
Fidgety	0.80	0.01	0.01
Distractible	0.60	0.20	0.27
Reflective	0.54	0.35	0.15
Persistent	0.48	0.31	0.27
Solitary	-0.11	0.25	0.45
Good Friend	0.05	0.25	0.22
Popular	-0.03	0.39	0.28
Bullied	0.09	0.12	0.42
Best with adults	0.12	-0.02	0.20
Considerate	-0.34	-0.67	-0.01
Shares	-0.20	-0.64	-0.06
Caring	-0.18	-0.69	-0.03
Kind to kids	-0.24	-0.61	-0.02
Helps out	-0.21	-0.66	-0.05

Fig. 1 displays the path diagram and the corresponding WLS estimates of the three-factor CFA model. The path diagram shows the relationships between the three dimensions (Externalisation Internalisation and Prosocial factors) and their relationships with the twenty observed items. The Externalisation factor respectively explained 84%, 77%, 76%, 74% and 71% of the variances of the items *Distractible*, *Fight*, *Persistent*, *Lies* and *Tempers*. The Internalisation factor explains 91% of the variance of the item *Unhappy* and the Prosocial factor explains 79% of the variance of the item *Considerate*. The majority of the standardized factor loadings exceed 0.7, indicating that the latent factors strongly affect 18 of the observed variables and moderately affect the remaining 2 items: *Solitary* and *Bullied*. Furthermore, the CFI (0.93), GFI (0.98), AGFI (0.97), NFI (0.92), NNFI (0.92), IFI (0.93) and RFI (0.91) all exceed their threshold values indicating a well-fitted model. Moreover, the Hoelter's Critical *N* (393.5) exceeds the 200 cut-point and the RMSEA value (0.06) is less than the 0.07 threshold value suggested by Steiger (2007). All these fit indices satisfy their threshold criteria, which indicate that this three-factor CFA model (Model 1) fits the data well.

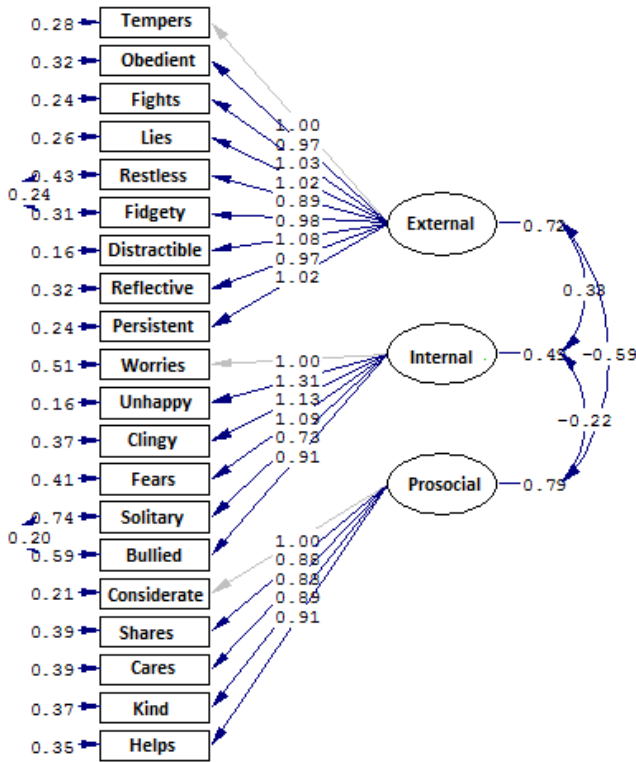


Figure 1: Path diagram of the three-factor CFA Model (Model 1).

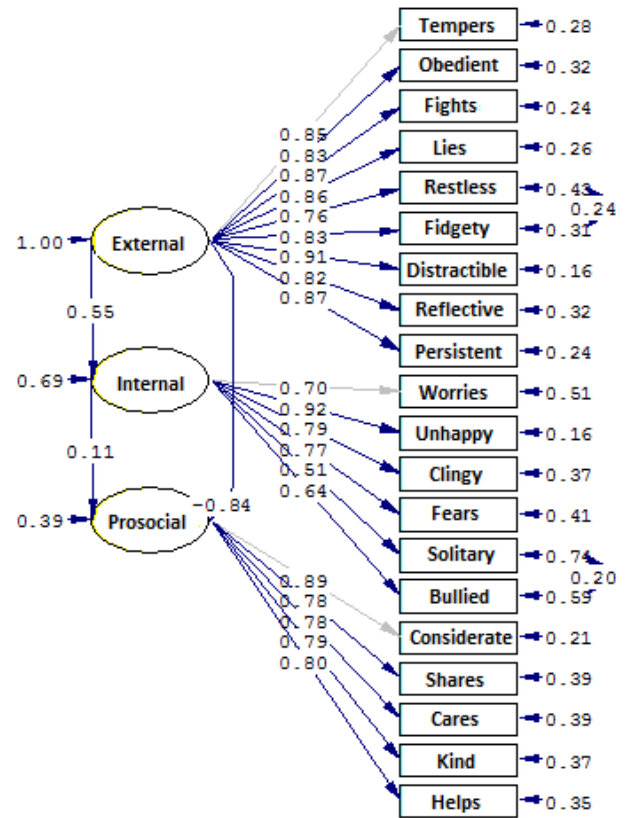


Figure 2: Path diagram of the three-factor SEM Model (Model 2).

4.4 Structural Equation Modelling (SEM)

A three-factor structural equation model was also fitted on this SEBD dataset using LISREL (version 8.8) software to investigate the relationships existing between the latent variables. Essentially this involves regressing latent variables on one another.

Fig. 2 displays the path diagram of this three-factor SEM model, which shows the relationships between the Externalisation, Internalisation and Prosocial factors and their relationships with the 20 observed items. Once the model was specified, the *t*-rule was used to check that this three-factor SEM fitted has model identification. The model parameters were estimated using a weighted least squares estimation (WLS) technique. The corresponding factor loadings, phi-paths and theta-deltas estimates are all significant since their standard errors are less than half the value of the parameter estimates. The CFI (0.92), GFI (0.98), AGFI (0.97), NFI (0.92), NNFI (0.91), IFI (0.92) and RFI (0.91) all exceed their threshold values by a small margin indicating a plausible fit.

This model can be extended further by accommodating the nesting structure of the data, where individuals are nested in classes.

4.5 A CFA Model in a Multilevel Framework

By fitting a two-level three-factor CFA model on this dataset, one can now estimate the between-level and the within-level loadings. This model explains the relationship existing at the class-level (Level-2) and at the individual-level (Level-1). In contrast the CFA model shown in Fig. 1 ignores this variation amongst the units. From this analysis, it was found that the within-level correlations range from -0.567 to 0.767 , whilst the between-level correlations range from -0.572 to 0.830 .

The three-factor model displayed in Fig. 1 was fitted at both Level-1 (student level) and at Level-2 (class-level). In this study, a WLSMV estimation technique was utilised following Múthen's (1984) recommendation. The WLSMV estimation technique is the most suitable estimation technique utilised for ordinal data. Furthermore, the WLSMV estimation technique for this analysis was carried out using the delta parameterisation. The delta parameterisation sets the measurement residuals equal to a value of 1. As pointed out by Newsom (2014), this parameterisation can be considered to be a variant of the probit model.

The number of clusters existing in this analysis was 1321 and the quasi-average cluster size was found to

Table 2: The estimated Intra-class Correlation Coefficient (ICCs).

Variable Description	Intra-Class Correlation
Temper	0.237
Obedient	0.214
Fights	0.189
Lies	0.204
Restless	0.153
Fidgety	0.138
Distractible	0.180
Reflective	0.195
Persistent	0.208
Worries	0.230
Unhappy	0.221
Clingy	0.249
Fears	0.228
Solitary	0.131
Bullied	0.220
Considerate	0.248
Shares	0.333
Cares	0.329
Kind	0.380
Helps	0.280

be equal to 3.936. Table 2 displays the intra-class correlation coefficients of these twenty observed variables. This table shows that all the intra-class correlations are greater than 0.10 illustrating that the effects of classes are influencing the teachers' rating scores. As pointed out by Gajewski, Boyle, Miller, Oberhelman and Duntun (2010), this further shows that the multilevel CFA is appropriate for particular dataset. Furthermore this result also indicates that the effects of class are strongly influencing the SEBD rating scores provided by the teachers.

The fitted two-level three-factor CFA model is considered to be identified since the same factor structure holds in both the within and the between-level. Table 3 displays the unstandardised factor loadings at the within-level, where all loadings are significant. Moreover, the mean standardised loading of the observed variables at the within-level was found to be equal to 0.7283.

Table 4 shows the unstandardised factor loadings at the between-level, where nearly all loadings are significant. Moreover, the mean standardised loading of the observed variables at the between-level was found to be equal to 0.7736. The fit indices showed that this model fits the data adequately well. The CFI (0.839) and TLI (0.815) all exceed their threshold values by a small margin indicating a plausible fit. Furthermore, the Hoelter's Critical N (325.96) exceeds the 200 cut-point

Table 3: Factor loadings at Level-1 of the CFA model. Here, Est. represents the Parameter Estimate and S.E. is the Standard Error.

Within-level	Est.	S.E.	Est./S.E.	p -value
Externalisation by				
C1			Aliased	
C2	1.298	0.066	19.571	0.000
C3	1.585	0.089	17.763	0.000
C4	1.358	0.076	17.948	0.000
C5	0.878	0.045	19.601	0.000
C6	1.089	0.053	20.579	0.000
C7	1.524	0.074	20.576	0.000
C8	1.415	0.072	19.651	0.000
C9	1.466	0.074	19.817	0.000
Internalisation by				
E1			Aliased	
E2	1.868	0.144	12.972	0.000
E3	1.466	0.092	16.019	0.000
E4	1.693	0.109	15.468	0.000
E5	0.892	0.062	14.481	0.000
E6	1.073	0.079	13.586	0.000
Prosocial by				
P1			Aliased	
P2	0.533	0.033	16.263	0.000
P3	0.571	0.034	16.960	0.000
P4	0.593	0.038	15.488	0.000
P5	0.614	0.037	16.622	0.000
Externalisation with				
Internalisation	0.083	0.015	5.626	0.000
Prosocial	-1.128	0.079	-14.279	0.000
Internalisation with				
Prosocial	-0.21	0.032	-6.549	0.000
C5 WITH				
C6	0.767	0.011	69.774	0.000
E5 WITH				
E6	0.222	0.035	6.343	0.000
Variances				
Externalisation	0.839	0.068	12.277	0.000
Internalisation	0.508	0.044	11.565	0.000
Prosocial	3.286	0.318	10.347	0.000

and the RMSEA value was (0.059), which is less than the 0.07 threshold value suggested by Steiger (2007). Additionally, the SRMR value of the within-level was (0.108), whilst the SRMR value of the between-level was (0.107). This indicates that this model fits slightly better the data at Level-1 (Individual-level) than at Level-2 (Class-level).

The mean standardised loading of the observed vari-

Table 4: Factor loadings at Level-2 of the CFA model.

Between-level	Est.	S.E.	Est./S.E.	p-value
Externalisation by				
C1			Aliased	
C2	1.072	0.105	10.243	0.000
C3	1.133	0.112	10.127	0.000
C4	1.129	0.108	10.462	0.000
C5	0.627	0.066	9.492	0.000
C6	0.781	0.074	10.495	0.000
C7	1.179	0.105	11.278	0.000
C8	1.018	0.103	9.855	0.000
C9	1.068	0.107	10.014	0.000
Internalisation by				
E1			Aliased	
E2	1.449	0.150	9.682	0.000
E3	1.568	0.158	9.921	0.000
E4	1.505	0.141	10.640	0.000
E5	0.651	0.092	7.039	0.000
E6	1.031	0.145	7.111	0.000
Prosocial by				
P1			Aliased	
P2	0.788	0.060	13.140	0.000
P3	0.774	0.056	13.760	0.000
P4	0.866	0.067	12.960	0.000
P5	0.670	0.050	13.340	0.000
Externalisation with				
Internalisation	0.236	0.031	7.605	0.000
Prosocial	-0.361	0.052	-6.947	0.000
Internalisation with				
Prosocial	-0.191	0.033	-5.788	0.000
C5 WITH				
C6	0.100	0.027	3.674	0.000
E5 WITH				
E6	-0.013	0.028	-0.461	0.645
Variances				
Externalisation	0.315	0.051	6.119	0.000
Internalisation	0.207	0.035	5.838	0.000
Prosocial	1.274	0.162	7.842	0.000

ables at the between-level was found to be higher than the mean standardised loading of the observed variables observed at the within-level. The reason behind this fact is that the between-level is based on the means. Consequently, these means are more reliable when compared to the raw scores and in this case a lot of measurement error was eliminated. It was also noticed that generally, the obtained standardised factor loadings are substantially higher at the class-level than the individual-level. Tables 5 and 6 show the obtained multiple cor-

Table 5: The obtained multiple correlations values of the within-level.

Variable	Within-Level			
	Estimate	S.E.	Est./S.E.	p-value
Temper	0.456	0.020	22.575	0.000
Obedient	0.586	0.018	31.912	0.000
Fights	0.678	0.021	33.088	0.000
Lies	0.607	0.021	29.220	0.000
Restless	0.393	0.017	22.750	0.000
Fidgety	0.499	0.017	30.118	0.000
Distractible	0.661	0.014	45.811	0.000
Reflective	0.627	0.015	42.847	0.000
Persistent	0.643	0.015	42.901	0.000
Worries	0.337	0.019	17.440	0.000
Unhappy	0.639	0.030	21.261	0.000
Clingy	0.522	0.023	23.179	0.000
Fears	0.593	0.024	24.322	0.000
Solitary	0.288	0.024	12.011	0.000
Bullied	0.369	0.028	13.303	0.000
Considerate	0.767	0.017	44.348	0.000
Shares	0.483	0.019	25.314	0.000
Cares	0.517	0.018	28.249	0.000
Kind	0.536	0.021	25.179	0.000
Helps	0.554	0.018	30.239	0.000

relations (R^2) values obtained at the within-level and at the between-level respectively. These values suggest the strength of every observed variable in measuring the corresponding factor at each level. Similarly to the standardised factor loadings, the multiple correlations values are in general higher at the class-level than the individual-level. As shown in Tables 3 and 4, the strongest item in measuring the Externalisation Factor is the item *Fights* at the within-level and the item *Distractible* at the between-level. Moreover, the strongest item in measuring the Internalisation Factor is the item *Unhappy* at the within-level and the item *Clingy* at the between-level. Furthermore, the strongest item in measuring the Prosocial Factor in both the within and between-level is the item *Considerate*.

If ψ_W and ψ_B are the within-level and the between-level variances then the intra-class correlations for the latent externalisation, internalisation and prosocial factors are

$$ICC_E = \rho_E = \frac{\psi_B}{\psi_B + \psi_W} = \frac{0.315}{0.315 + 0.839} = 0.273, \quad (10)$$

$$ICC_I = \rho_I = \frac{\psi_B}{\psi_B + \psi_W} = \frac{0.207}{0.207 + 0.508} = 0.290, \quad (11)$$

Table 6: The multiple correlations values of the between-level.

Variable	Between-Level			<i>p</i> -value
	Estimate	S.E.	Est./S.E.	
Tempera	0.550	0.056	9.844	0.000
Obedient	0.549	0.054	10.204	0.000
Fights	0.558	0.068	8.151	0.000
Lies	0.616	0.065	9.534	0.000
Restless	0.415	0.067	6.198	0.000
Fidgety	0.602	0.071	8.422	0.000
Distractible	0.675	0.048	14.057	0.000
Reflective	0.503	0.049	10.332	0.000
Persistent	0.488	0.045	10.763	0.000
Worries	0.459	0.065	7.003	0.000
Unhappy	0.553	0.069	8.057	0.000
Clingy	0.735	0.071	10.300	0.000
Fears	0.648	0.075	8.643	0.000
Solitary	0.415	0.096	4.313	0.000
Bullied	0.492	0.087	5.665	0.000
Considerate	0.900	0.054	16.652	0.000
Shares	0.820	0.057	14.268	0.000
Cares	0.750	0.049	15.257	0.000
Kind	0.723	0.055	13.146	0.000
Helps	0.656	0.049	13.267	0.000

$$ICC_P = \rho_P = \frac{\psi_B}{\psi_B + \psi_W} = \frac{1.274}{1.274 + 3.286} = 0.279. \quad (12)$$

4.6 A SEM Model in a Multilevel Framework

A two-level three-factor SEM model was also fitted on this SEBD dataset by using the software Mplus (version 6). A two-level three-factor SEM model illustrates the relationships existing amongst the three factors: Externalisation, Internalisation and Prosocial Factors. Following, the analysis of fitting a SEM model, it was intuitively observed that in this two-level model, the Internalisation Factor depends on the Externalisation Factor, the Prosocial Factor depends on the Externalisation Factor and the Prosocial Factor depends on the Internalisation Factor. This fitted two-level three-factor SEM model is considered to be identified since the same factor structure holds in both the within and the between-level. Tables 7 and 8 display the unstandardised factor loadings, standard errors, Wald statistics and *p*-values at the within-level and the between-level of the three-factor SEM model.

All the obtained unstandardised and standardised factor loadings of the two-level SEM model at the within-level are considered to be significant since their standard errors are less than the half the value of the loadings. Moreover, their Wald test statistics are greater than |1.96| and their corresponding *p*-values are less

Table 7: Factor loadings at Level-1 of the CFA model.

Within-level	Est.	S.E.	Est./S.E.	<i>p</i> -value
Externalisation by				
C1			Aliased	
C2	1.298	0.066	19.570	0.000
C3	1.585	0.089	17.760	0.000
C4	1.358	0.076	17.950	0.000
C5	0.878	0.045	19.600	0.000
C6	1.089	0.053	20.580	0.000
C7	1.524	0.074	20.580	0.000
C8	1.415	0.072	19.650	0.000
C9	1.466	0.074	19.820	0.000
Internalisation by				
E1			Aliased	
E2	1.868	0.144	12.970	0.000
E3	1.466	0.092	16.020	0.000
E4	1.693	0.109	15.470	0.000
E5	0.892	0.062	14.480	0.000
E6	1.073	0.079	13.590	0.000
Prosocial by				
P1			Aliased	
P2	0.533	0.033	16.260	0.000
P3	0.571	0.034	16.960	0.000
P4	0.593	0.038	15.490	0.000
P5	0.614	0.037	16.620	0.000
Externalisation with				
Internalisation	0.021	0.024	0.886	0.376
Prosocial	-0.342	0.023	-15.090	0.000
Internalisation with				
Prosocial	-0.206	0.010	-6.305	0.000
C5 WITH				
C6	0.767	0.011	69.770	0.000
E5 WITH				
E6	0.222	0.035	6.343	0.000
Variances				
Externalisation	0.452	0.037	12.140	0.000
Internalisation	0.495	0.043	11.440	0.000
Prosocial	3.286	0.318	10.350	0.000

than 0.05. On the other hand, nearly all the obtained unstandardised and standardised factor loadings at the between-level are significant since their standard errors are less than the half the value of the loadings with the exception of the parameter estimate existing amongst the observed variables *Bullied* and *Solitary*, the residual variance of the item *Considerate* and the residual variance of the *Externalisation Factor*.

Table 8: Factor loadings at Level-2 of the SEM model.

Between-level	Est.	S.E.	Est./S.E.	p-value
Externalisation by				
C1			Aliased	
C2	1.072	0.105	10.240	0.000
C3	1.133	0.112	10.130	0.000
C4	1.129	0.108	10.460	0.000
C5	0.627	0.066	9.492	0.000
C6	0.781	0.074	10.490	0.000
C7	1.179	0.105	11.280	0.000
C8	1.018	0.103	9.855	0.000
C9	1.068	0.107	10.010	0.000
Internalisation by				
E1			Aliased	
E2	1.449	0.150	9.682	0.000
E3	1.568	0.158	9.921	0.000
E4	1.505	0.141	10.640	0.000
E5	0.651	0.092	7.039	0.000
E6	1.031	0.145	7.111	0.000
Prosocial by				
P1			Aliased	
P2	0.788	0.060	13.140	0.000
P3	0.774	0.056	13.760	0.000
P4	0.866	0.067	12.960	0.000
P5	0.670	0.050	13.340	0.000
Externalisation with				
Internalisation	1.021	0.137	7.443	0.000
Prosocial	-0.131	0.035	-3.744	0.000
Internalisation with				
Prosocial	-0.150	0.025	-5.906	0.000
C5 WITH				
C6	0.100	0.027	3.674	0.000
E5 WITH				
E6	-0.013	0.028	-0.461	0.645
Variances				
Externalisation	0.026	0.029	0.890	0.374
Internalisation	0.179	0.032	5.576	0.000
Prosocial	1.274	0.162	7.842	0.000

5 Conclusion

Table 9 shows the fit indices obtained for the single-level three-factor SEM models compared to the fit indices obtained for the two-level three-factor SEM model. Although the two-level SEM model reduced the CFI and RMSEA indices it did not yield the significant improvement that was expected considering the complexity of model. The reason is that the level-1 variance is considerably larger than the level-2 variance. This two-level

Table 9: Fit indices of the 1-level and 2-level SEM models.

Fit Index	Single-level SEM	Two-level SEM
CFI	0.920	0.839
RMSEA	0.061	0.059

SEM model would have been more appropriate if the level-2 variance explained a larger portion of the total variance.

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Xenophobic and Homophobic Attitudes in Online News Portal Comments in Malta

Stavros Assimakopoulos*¹ and Rebecca Vella Muskat¹

¹*Institute of Linguistics and Language Technology, University of Malta, Msida, Malta*

Abstract. In this paper, we present part of the research carried out at the Institute of Linguistics and Language Technology of the University of Malta under the auspices of the EU-funded C.O.N.T.A.C.T. project¹. The present study, which followed the common methodology of the C.O.N.T.A.C.T. consortium, focuses on the verbal expression of discrimination in Malta. Employing both quantitative and qualitative methods, we seek to identify the extent to which comments posted online in reaction to news reports in local portals can be found to encompass discriminatory attitudes towards two target minorities: migrants and members of the LGBTIQ community. The obtained results indicate that, while both xenophobia and homophobia can be detected in some of the comments, the former is a much more prevalent than the latter. In an attempt to further probe into the reasons for the emergence of such discriminatory discourse online, we additionally administered an online questionnaire and conducted focus group interviews, which provided us with some insight as to why discriminatory attitudes appear to have recently been on the rise in relation to migrants, while, at the same time, have correspondingly been contained in the case of the LGBTIQ minority group.

Keywords: critical discourse analysis, online comments, xenophobia, homophobia, hate speech

1 Introduction

When one speaks of discrimination in its broadest sense, one typically refers to prejudice based on any minority identity, be it tied to religion, nationality, race, ethnic origin, sexual orientation, gender identity, or any other

trait that legal terminology pertaining to hate speech and hate crime commonly calls a ‘protected characteristic’. Regardless of whether or not a discriminatory incident is indeed prosecutable by law, the underlying idea is that some person is discriminated against when they are singled out – and potentially insulted or even threatened – because they share some identifying feature with other members of a particular minority group.

In Malta, both the Constitution (Article 45) and the Criminal Code (Article 82) directly outlaw any form of discrimination (with the Press Act, the Broadcasting Act and the Employment and Industrial Relations Act also comprising further provisions in relation to it). Beyond the legal remit of discrimination, however, community perceptions are also quite complex. As the MGRM (Malta LGBTIQ Rights Movement) pointed out to us in our communication with them, before the relevant amendments to the Constitution and Criminal Code in 2013, when the Civil Union Act was ratified, society’s perception of the LGBTIQ community was ahead of legislation; there was more tolerance from society than was reflected in policy. Now, however, the converse seems to be the case; policy is quite ahead in terms of LGBTIQ rights and protections, and people need time to catch up. Similarly, a great source of contention for the Maltese is the problem of irregular migration in the Mediterranean, with the 2016 Eurobarometer survey (European Commission, 2016) enlisting migration as the highest concern locally. This seems to be spurring much of the discrimination against migrants on the Maltese islands, where irregular migrants, alongside anyone perceived to be one on the basis of their physical characteristics, are often categorised as one group of ‘Others’, regardless of their nationality, language, religion, or ethnic background (cf. Lutterbeck, 2009; Cassar & Gauci, 2015; Repeckaite, Cassar & Gauci, n.d.).

¹The full *C.O.N.T.A.C.T. National Report for Malta* can be accessed here: http://staff.um.edu.mt/_data/assets/pdf_file/0007/328903/CONTACTNationalreportforMaltaUM-Malta.pdf

*Correspondence to: Stavros Assimakopoulos (stavros.assimakopoulos@um.edu.mt)

Against this background, the 2-year EU-funded C.O.N.T.A.C.T. project (cf. Assimakopoulos, Baider & Millar, 2017) aimed at investigating and developing tools to combat hate crime, with a particular focus on hate speech, in a number of EU countries. These tools included an online facility and dedicated smartphone application where members of the public could report hate incidents, as well as various media and training events across the consortium (for more information visit: <http://reportinghate.eu>). And while the local reports we received through our dedicated online facility will not be analysed in this article, they still suggest that the focus of the project on hate speech seems to be particularly relevant. As Figure 1 indicates, as of October 2017, out of the 112 reports received for Malta, the largest proportion had to do with instances of verbal abuse, with online hate speech also featuring quite high in the list.²

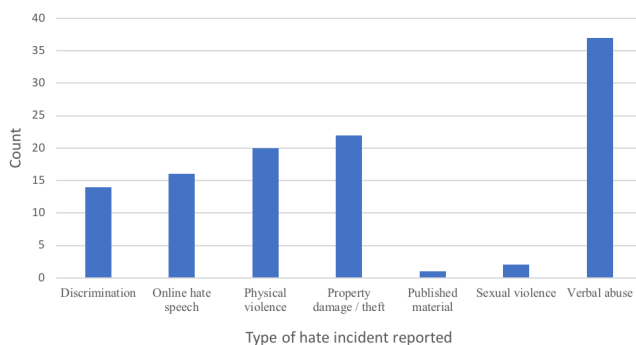


Figure 1: Reports of hate incidents in Malta on the C.O.N.T.A.C.T. website.

In this respect, the present study aimed to investigate the extent to which xenophobic and homophobic³ attitudes can be seen to emerge in online discourse produced by the general public. To this end, adopting a critical discourse analytic approach, we examined the language used in comments posted in reaction to news reports in various local media portals with a view to uncovering the underlying ideologies associated with these two types of discrimination in Malta. In this setting, ideology can be roughly defined as a “an interrelated

²Clearly, this is not meant to be taken as a general statistic applicable to the whole population residing in Malta; yet, it is still indicative of a tendency that should not be overlooked.

³Throughout this article, ‘homophobia’ will be used as an umbrella term that encompasses homophobia, transphobia, biphobia and any other discriminatory attitude towards LGBTIQ individuals. Similarly, the term ‘xenophobia’ will be used as an umbrella term to refer to any discriminatory attitude against a person or group of persons on the basis of their race, religion, country of origin, and ethnicity. Although this is a somewhat inaccurate use of the two terms, as will become clear through the following discussion, the aforementioned characteristics are also often conflated by members of society.

set of convictions or assumptions that reduces the complexities of a particular slice of reality to easily comprehensible terms and suggests appropriate ways of dealing with that reality” (Hunt, 1987: xi); that reality being, in the present context, the existence of migrants and LGBTIQ individuals in Malta. Therefore, going beyond the mere identification of current trends in discriminatory attitudes towards the two minorities under question, we also sought to ascertain, in an empirically grounded way, the ideological background against which these trends can be taken to have emerged.

Critical discourse analysis is an area of research that is rooted fundamentally in critical linguistics (Teo, 2000). As such, it moves beyond the mere description of language and offers explanations and evaluations as to how and why discourses are produced. In this way, it seeks to ascertain the role that various discourses can have in the production and reproduction of sociological phenomena such as dominance, power, and belief (cf. Fairclough, 1995). That is precisely why it has been widely applied to the study of discrimination, since it allows researchers to link the linguistic structures and units adopted in discourse with the hidden ideologies imbued therein (see, for example, van Dijk, 1987, 1991; Reisigl & Wodak, 2001; Baker et al., 2008, among many others). For example, van Dijk (1992: 228) shows how forms of understatement, such as mitigation and euphemism, do not only offer semantic and rhetorical functions to discourse, but often also serve to “avoid negative judgements of the hearer about the ethnic attitudes of the speaker”, thus, implicitly downplaying the racist stance that a certain remark may communicate. And indeed, even from common experience, it should be easy to identify instances of talk, where a speaker starts off with the hedge “*I am not racist but...*” and then goes on to pass a racist comment. Along similar lines, in his analysis of the portrayal of homosexuality in African newspapers, Reddy (2002) notes that the negative evaluation of homosexuality therein is often underpinned by an anti-European and anti-West argumentation, hence implying that homosexuality is ‘unAfrican’.

While most previous research in the area has predominantly focused on the communication of discriminatory attitudes in newspeak and media talk, the recent emergence of Web 2.0 as a principal platform for the exchange of ideas concerning minorities (in the form of social media platforms such as Facebook, and newspaper forums, for example) clearly necessitates the investigation of the relevant attitudes in the interactions of internet users too (cf. Erjavec & Kovačič, 2012; Brindle, 2016). So, in the interest of understanding the driving forces behind the general public’s production of remarks that reveal a discriminatory attitude towards migrants or members of the LGBTIQ community in Malta, we created two

balanced corpora of articles and comments related to the two minority groups under question, and annotated them in terms of the attitudes they reveal as well as the means used to communicate these attitudes. Then, with a view to approximating the general public's perception of such discriminatory comments, we administered a questionnaire online and ran four follow-up focus group interviews. In this respect, we employed the principle of triangulation, fundamental for several strands of critical discourse analysis, "which enables the researchers to minimize any risk of being too subjective," given "its endeavour to work on a basis of a variety of different data, methods, theories, and background information" (Wodak, 2015: 2). As we will see in the following sections, this enabled us to ascertain the local presence of a negative attitude towards both minorities, and identify at the same time its more particular ideological underpinnings in each case.

2 Materials and Methods

The common methodology used across the C.O.N.T.A.C.T. consortium, and its underlying rationale, is available in Assimakopoulos et al. (2017: Chapter 2), but for the sake of transparency we will briefly outline it below too, taking note of those steps in which we deviated from the original plan, given Malta's particular linguistic landscape. Before we turn to this though, it is essential to point out that, while the focus of the C.O.N.T.A.C.T. project was indeed on hate speech, we are in no position, as researchers of language and ideology, to accuse particular commenters that they have committed what amounts to a crime in the eyes of the Maltese law. So, all the statistical analysis and especially the examples⁴ provided in this article should not be perceived as constituting hate speech in the legal sense of the term. Rather, they are emphatically meant to represent instances of discourse that encompasses a discriminatory attitude towards migrants or members of the LGBTIQ community, and therefore provides an idea of the axiological values that underlie this attitude.

2.1 Analysis of Online Comments in the Maltese Online Press

2.1.1 Data Collection

In order to build our corpus for the first stage of our research, we needed to identify articles that could potentially trigger readers to post comments pertaining to the migrant and LGBTIQ minorities underneath them. To this end, following the common C.O.N.T.A.C.T. methodology, we looked for articles related to the top-

ics of hate speech/crime, migration and LGBTIQ matters, by identifying particular keywords that are relevant in these domains. Still, the bilingual character of Malta, where both Maltese and English are official languages, necessitated a number of important decisions in the process. Firstly, as can be expected, exact translations of terms from/to Maltese are sometimes difficult to come by; for example, the lexical item '*asylum seeker*', translates only periphrastically to '*persuna li tfitteq il-kenn*' (literally: person who is looking for shelter) – in which case we opted to search for articles containing the more generic keywords '*kenn*' and '*ażil*' (asylum) in Maltese-language news portals. Secondly, particular attention needed to be paid to words containing Maltese-specific graphemes. The Maltese and English alphabets both make use of Latin characters; yet, the Maltese alphabet differs marginally from the English one as it does not have a <y> and additionally has the following characters: <ċ>, <ġ>, <għ>, <h>, and <ż>. The reason that these graphemes became relevant at this stage of data collection is that Maltese characters are not consistently used in Maltese-language press. For example, the word '*ażil*' also returned results with its 'Anglo'-spelling '*azil*'. Finally, both the singular and plural forms of countable nouns were used in the database search, under the assumption that linguistic choice between the two forms may have ideological consequences that could become apparent during the qualitative analysis of the data. Against this backdrop, Table 1 shows all keywords that were used to identify articles for the Maltese C.O.N.T.A.C.T. dataset.

We then used the EMM NewsBrief platform (<http://emm.newsbrief.eu>), which has been developed by the Joint Research Centre of the European Commission to monitor news reports across the globe, to look for articles from local media portals by performing searches on the basis of our selected keywords. We collected the titles and URLs for all retrieved articles, in both English and Maltese, over two time periods, which were preselected across the consortium for reasons of feasibility: April–June 2015 and December 2015–February 2016. Once we retrieved all articles and their respective urls for each keyword, we selected the keywords that would be used for the population of our actual corpora on the basis of the number of articles that each keyword returned during our initial search. While the rest of the consortium populated their corpora with content pertaining to 8 keywords on migration and 6 on LGBTIQ matters, we chose to create a more balanced corpus by using the 8 keywords that returned most hits in each domain. Table 2 shows the overall number of hits of the keywords selected, which were also the keywords with the most number of hits across the board, returning more articles than any of the keywords in the hate speech/crime domain.

⁴All examples of online comments have been reproduced in their exact original form, so any apparent grammatical mistakes are taken verbatim from the original writers.

Table 1: Keywords used for data collection in Malta.

Domain	Keywords searched for
Hate speech /crime	IN ENGLISH: discrimination, hate, hate crime, hate crimes, hate speech IN MALTESE: diskriminazzjoni, mibegħda, reat ta' mibegħda, reati ta' mibegħda, diskors ta' mibegħda
Migration	IN ENGLISH: asylum, asylum seeker, asylum seekers, black, blacks, immigrant, immigrants, immigration, migrant, migrants, Muslim, Muslims, push-back, pushback, race, racial, racism, refugee, refugees, shelter, xenophobia IN MALTESE: azil, azil, persuna li tfittex il-kenn, persuni li jfittxu il-kenn, iswed, l-iswed, immigrant, immigranti, immigrazzjoni, migrant, migranti, Musulman, Musulmani, push-back, pushback, razza, razziali, razzizmu, refuġjat, refuġjati, refuġjati, refuġjati, kenn, ksenofobija
LGBTIQ	IN ENGLISH: civil union, gay, gays, gender identity, homophobia, homosexual, homosexuals, lesbian, lesbians, LGBT, LGBTIQ, queer, queers, sexuality, sexual orientation, trans, transgender, transgenders, transexual, transexuals IN MALTESE: unjoni ċivili, unjoni civili, gay, gays, identità tal-gġeneru, identità tal-generu, omofobija, omosesswali, liżbjana, lesbjana, liżbjani, lesbjani, LGBT, LGBTIQ, queer, queers, sesswalità, orjentazzjoni sesswali, trans, transgender, transgenders, transesswali

At first sight, even from the number of hits alone, one can easily see that media discourse related to the topic of migration is far more prominent than that related to LGBTIQ matters, with the keyword registering the highest number of hits in the LGBTIQ category returning fewer hits than the keyword that was last in our list for the migration domain.

Once the 8 keywords per topic area were selected, we went back to our list of articles and discarded all articles that did not contain any of the selected keywords. Since the EMM Newsbrief tool does not provide any information about articles with associated comments, we added to our list of the remaining article URLs a separ-

Table 2: Keywords used for the population of the Maltese corpus.

Domain	Keyword	Sources in English	Sources in Maltese	Total number of hits
Migration	migrant/s	2227	35	2262
	refugee/s	1116	241	1357
	immigrant/s	334	811	1145
	asylum (seeker/s)	424	0	1100
	Muslim/s	776	176	952
	immigration	485	403	888
	race	826	58	884
LGBTIQ	black/s	745	111	856
	gay/s	322	51	373
	LGBT/LGBTIQ	123	33	156
	homosexual/s	98	54	152
	sexual orientation	71	55	126
	gender identity	116	2	118
	transgender/s	70	12	82
	homophobia	20	53	73
	lesbian/s	58	5	63

ate column with the number of comments that each one of these articles had received. At the end of this process, we had a list of all the articles with comments over the designated temporal period, along with the number of comments each article had received. At this stage, we were ready to start compiling our corpus.

Since the next part of this research included a more nuanced qualitative analysis, the Maltese C.O.N.T.A.C.T. corpus had to contain a smaller, albeit representative and balanced sample of the collected articles. So, while the rest of the consortium used a more randomised sampling method, we developed a method that we felt would ensure that the collected comments would include ideologically-marked language. Identifying those articles with the largest number of user comments was pivotal in this respect. Using both already available text-mining software and an additional computational method developed by Albert Gatt, another member of the University of Malta team, all articles retrieved from the previous step of the process and their accompanying comments were collected and organised according to the number of comments received per article. Then, we collected the first 5,000 words worth of article content – as well as an associated 5,000 words worth of comments content – per keyword, on the basis of the number of comments received per article. Care was taken not to select partial articles or cut off individual comment threads. Therefore, the data for

Table 3: Overview of the Maltese corpus.

		Article source language							
		English				Maltese			
	Keyword	No. of articles	Size of article corpus (in words)	No. of comments	Size of comments corpus (in words)	No. of articles	Size of article corpus (in words)	No. of comments	Size of comments corpus (in words)
		Migration corpus	asylum seeker/s	16	4800	147	5108	3	887
black/s	7		5264	137	5096	0	0	0	0
immigrant/s	7		4877	147	5064	19	5216	114	3125
immigration	10		4853	130	5252	11	3818	44	920
migrant/s	11		5073	156	5257	0	0	0	0
Muslim/s	13		5246	169	5009	12	2572	55	1629
race	5		4877	141	4961	1	354	1	12
refugee/s	9		4809	103	5273	8	2466	25	1033
TOTAL	78		39799	1130	41020	54	15313	240	6729
LGBTIQ corpus	gay/s	14	5070	142	5051	5	961	21	520
	gender identity	8	4960	163	5012	0	0	0	0
	homophobia	9	5100	133	5176	0	0	0	0
	homosexual/s	9	5843	169	5120	5	1237	14	356
	lesbian/s	13	5688	116	5008	0	0	0	0
	LGBT/IQ	10	5260	136	5021	0	0	0	0
	sexual orientation	7	4737	114	5268	0	0	0	0
	transgender/s	10	5615	136	5268	0	0	0	0
	TOTAL	80	42273	1109	40924	10	2198	35	876

most keywords in the corpus ended up containing either slightly more or less than 5000 words (cf. Table 3).

Overall, as Table 4 shows, the Maltese C.O.N.T.A.C.T. corpus ended up containing an array of articles from several major local news portals, as the EMM NewsBrief platform automatically crawls the vast majority of news portals in the country.

2.1.2 Data Annotation

The next step involved the annotation of both our articles and comments subcorpora in the two domains in terms of polarity. The objective here was to identify whether each article/comment communicated a positive, negative or neutral stance towards the minorities under question. What is particularly important to note in this regard is that during this evaluation, which was undertaken by two individual annotators to ensure reliability, we focused exclusively on the attitudes expressed in relation to migrants and members of

the LGBTIQ community, marking any content that related to a different target, such as politicians or other commenters, as irrelevant. So, following the common C.O.N.T.A.C.T. methodology, once a comment was labelled in terms of polarity, the discursive tactics used by the writer of the comment to communicate a positive or negative stance towards the targeted minority groups were pinpointed through a closer analysis that involved the following categories, as these stem from the relevant critical discourse analytic literature:

- Use of positive words and derogatory terms to refer to the minority under question, e.g. *“That’s because we’re not simply importing destitute people. We’re importing a discredited, disheveled and destructive culture.”*
- Insults against the minority under question, e.g. *“If anyone is lacking, it is you guys for lacking a sense*

Table 4: Local news portals taken into account for the Maltese corpus.

Portal	Portal name	Used	Reason for exclusion from coprus
English	<i>Bay</i>	✗	Articles expire after 2 weeks
	<i>Malta Star</i>	✗	Redirects to onenews.com, and all articles therein are now in Maltese.
	<i>Malta Today</i>	✓	
	<i>The Malta Independent</i>	✓	
	<i>Times of Malta</i>	✓	
Maltese	<i>Grajjet Malta</i>	✗	Website down
	<i>Illum</i>	✓	
	<i>iNews Malta</i>	✗	No comments found under retrieved articles
	<i>Kullhadd</i>	✗	No comments found under retrieved articles
	<i>L-Orizzont</i>	✗	Redirects to iNews
	Malta Right Now (changed to Net News)	✓	
	<i>TVM</i>	✗	No comments section available

of decency. Just look at the costumes worn at gay parades to prove my point.”

- Metaphorical associations of the minority under question, e.g. “Illegal immigration is a cancer which if not eliminated will bring the downfall of Europe and European culture.”
- Generalisations/sweeping statements about the minority under question, e.g. “It is sadly getting to the point where being transgender will be a compulsory requirement. This has gone far enough.”
- Remarks based on a stereotypical representation of the minority under question, e.g. “Homosexuals who indulge in homosexual acts are committing grievous sins too because any sexual act outside of marriage is a grievous sin.”
- Suggestions about a plan of action in relation to the minority under question, e.g. “meta eu sejra tokkupa il costa tal libja biex ma halluhomx jitolqu it tort kollu tal eu nies bla ba d” (When is the EU going to go occupy the coast of Libya to stop them

from leaving? The fault is with the whole of the EU, people without balls.)

- Implicit communication of a negative or positive attitude towards the minority under question, in terms of implicature⁵, e.g. “Will the treatment given to this “Human Being” [referring to a migrant] be given to me if I do the same? Or since being Maltese I will be discriminated against?”
- Agreement with and/or endorsement of previous negative or positive comment towards the minority under question, e.g. “Well said !! A very stupid idea . When are we going to draw a line to these outlandish laws [regarding trans, gender variant, and intersex students] and behave normally again ?”
- Counterargument to a previous negative or positive argument in relation to the minority under question, e.g. “If you want to be credible, enlighten us how ‘pushback’ is showing solidarity??!”

Much like in the aforementioned cases of van Dijk (1992) and Reddy (2002), a further analysis of these strategies and the patterns in which they emerge in this particular discourse setting allowed us to identify how commenters “use language and grammatical features to create meaning, to persuade people to think about events in a particular way, sometimes even to seek to manipulate them while at the same time concealing their communicative intentions” (Machin & Mayr, 2012: 1).

2.2 Perceptual Study

In the second part of the present study, we carried out an assessment of the perceptions of the local population in relation to actual examples of discriminatory discourse from our corpus, and then sought to gain further insight into the obtained results on the basis of a series of follow-up focus group interviews. Needless to say, ethical approval for this part of the research was sought and obtained from the University of Malta Research Ethics Committee, and informed consent was obtained from all participants of both the questionnaire and focus group interviews.

2.2.1 Questionnaire

The relevant questionnaire, which was again developed following the common C.O.N.T.A.C.T. methodological approach, was circulated on Google Forms both in English and Maltese and distributed using multiple University of Malta mailing lists and Facebook group posts. In

⁵The term implicature, famously coined by Grice (1975), is used to denote meaning that is communicated over and above what is actually expressed by the use of an utterance. As such, it encompasses a host of related phenomena, such as irony and sarcasm or the use of discourse markers, which we will not go into in the present article due to space restrictions (see, however, Vella Muskat & Assimakopoulos, 2017).

its first section⁶, respondents were given six examples of online comments in reaction to news stories pertaining to migrant and LGBTIQ minorities and were asked to indicate how acceptable they think it is for people to post such comments online. Our selection of the relevant comments from our corpus followed the consortium’s guidelines and included in turn: (i) a comment with a discriminatory statement that is directly offensive with regard to the relevant minority group, (ii) another one that carries a discriminatory statement without explicitly offensive language and, (iii) a comment that, while negative in its polarity, includes some argumentation that would not necessarily qualify as discriminatory against the group under question. The relevant items used in the domain of xenophobia (1–3) and homophobia (4–6) were the following:

1. *“The German authorities tried to suppress this massive crime but with the number of women assaulted now at 200 and counting, it had to come out. The cat is now out of the bag and there is no way it will be bagged again. Immigration from third world countries destroys western societies.”*
2. *“Immigrants are not stupid. They love the freedom and rights they have over here. This is nothing but arrogance and it is what we should expect from them in the future. Maybe it’s you who’s in denial, but wake up and smell the coffee because it is starting to smell.”*
3. *“Multiculturalism as is being advertised by the pseudo liberals has failed BADLY. It is like putting the starter, main course and dessert in a liquidiser and eating everything together. It simply destroys the palate. European culture should be preserved in Europe; Arabian culture in Arab countries; Asian cultures in Asia, etc etc. This way all cultures can be appreciated without one culture subduing the other. We are ignoring the fact that some cultures are downright INCOMPATIBLE, and to try to impose cultural integration is asking for trouble.”*
4. *“The practice of homosexuality qualifies as a “disease” because by definition “disease is a disorder of the normal function of an organism”. The complicated anatomical structure and physiology of the sex organs leave no doubt that its normality consists in the fecundation of the female ovum by the male sperm and the further development of the zygote in the mother’s womb to produce a new separate living human organism.”*
5. *“These homosexuals are embarrassing us because*

⁶In the second part of the questionnaire, which we will not be dealing with in the present article, respondents were requested to provide information about their own experiences of hate speech in Malta, while delving further into the reasons why such incidents are often underreported.

they want the UNNATURAL be made NATURAL and they want it recognized as such.”

6. *“The gay community has become arrogant and aggressive towards achieving a one sided political agenda, completely in their favour, at the expense of all others’ human rights to live and procreate as nature intended.”*

The number of respondents totalled 199 for the English version, and 10 for the Maltese version of the questionnaire, i.e. 209 overall. Even though the C.O.N.T.A.C.T. methodology targeted only people from 18 to 35 years of age, we collected data across all age groups (cf. Fig. 2) with a view to gaining a wider understanding of the ways in which the general public as a whole conceptualize discriminatory discourse.

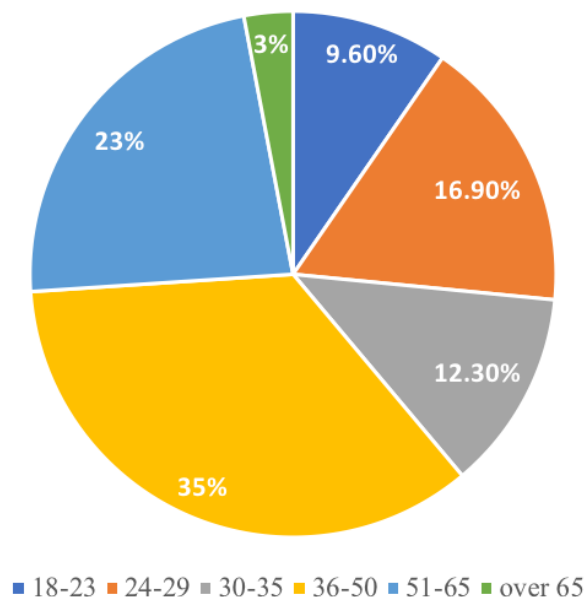


Figure 2: Questionnaire respondents age groups.

Regarding our respondents’ demographic information, 116 participants identified as female, 91 as male and 2 identified themselves in non-binary terms. Regarding their nationality, 181 respondents were Maltese (or held dual citizenship that includes Malta), 23 were non-Maltese EU nationals, and 5 non-EU ones. When it comes to religion, 137 of our respondents identified as Christian, 60 stated that they do not assimilate with any religion, while 7 assimilate with a faith that was not listed in the options provided in the questionnaire; yet, notably, none of our respondents were of Muslim faith. Turning to sexual orientation, 176 respondents identified as heterosexual, 22 as LGBTIQ and 4 as other. Finally, in terms of their level of education, the vast majority of our participants have reached a level of higher educa-

tion, with only 6 participants having reached secondary education alone.

2.2.2 Focus group interviews

After analysing the obtained questionnaire responses, we ran semi-structured focus group interviews with members of the general public who responded to our respective call for participants. These interviews were meant to help us probe into the particular answers that were collected through our questionnaire and approximate, in this way, the general public's opinion regarding the trends noted. Importantly, our interviewees were not asked to justify their own answers in the questionnaire (if, that is, they had already taken part in it in the first place); rather, they were asked to discuss the overall results obtained through the questionnaire administration. To this end, we conducted four focus group interviews with 21 participants, 11 female and 10 male, in total. Here, however, most participants were under 35 years of age, with 5 of them being older, while the groups comprised 13 Maltese, 6 EU and 2 non-EU nationals.

3 Results and Discussion

3.1 Xenophobic and Homophobic Attitudes in Online Comments

Our analysis of the collected articles revealed a predominantly neutral attitude towards the minorities under question, probably because all of them merely reported on current affairs pertaining to the two domains under study. Yet, our analysis of the comments posted underneath these articles painted a rather different picture, as the pie charts in Fig. 3 indicate⁷.

In view of these results, it is clear that while there is, in our corpus, a presence of a negative attitude towards both minorities that we are dealing with, this attitude is far more prevalent in relation to migrants than it is in relation to members of the LGBTIQ community, in which case, actually, the comments that were marked as positive significantly outnumber the negative ones.⁸ Still, the results obtained regarding xenophobic attitudes in the analysed comments present a rather dramatic situation, with negative comments being almost double in number

than those that defend this particular target group.⁹

Turning to the most prevalent trends that were identified in our analysis of the discursive tactics of commenters posting negative comments, we can get a better idea of the particular ideological stances that underlie xenophobic and homophobic attitudes locally.

To begin with, it is worth pointing out that an overwhelming majority of the comments that revealed a xenophobic stance had to do with a particular subgroup of migrants – i.e. the one comprising predominantly migrants of Muslim faith. The following examples of views that generalise over the relevant population showcase this, especially since each of them employs either the pronoun *they/them* or the determiner *these* to establish a clear *us versus them* dichotomy. In effect, this serves to expound the message that Muslim migrants are separate and different from the Maltese and, moreover, that they pose a threat to the traditional values and homogeneity of the island, in addition to bringing disease, crime, and degradation with them.

1. “... Wait another 5 years and see how **these Muslims** will change Malta...”
2. “... Turning a blind eye until such time as there are thousands around and the government has to raise taxes to support them, when **they** start building mosques next to **our** churches. Start positive discrimination in their favour? Start thinking before it's too late...”
3. “... Many epidemic diseases are brought from **their** shores such as AIDS, and the Ebola Virus, then because of the already lack in employment opportunities you will see a rise in Violent crimes in order for **them** in desperation to self support...”
4. “... just back from Florence and the city is full of **them**, soon **we** will be having organised crimes committed **by these people**...”

Then, even with respect to the group of Muslims, there appears to be a of conflation of identities whereby Muslims and sub-Saharan migrants are one and the same, with most negative comments targeting specifically those migrants who have not been granted legal residence status in Malta¹⁰. Although not all asylum

⁷It should be noted that these percentages have been calculated on the basis of the comments that were collected from English-language portals alone. This was necessary for the purposes of comparison, since, as is evident in Table 3, our search in Maltese-language portals did not yield enough comments.

⁸Interestingly, Malta was the only country in the C.O.N.T.A.C.T. consortium to obtain such a result, as all other national datasets revealed a more pronounced negative attitude towards both minority groups (cf. Assimakopoulos et al., 2017: 12–13).

⁹In fact, the situation becomes even more dire, if we also factor in that even more negative remarks about migrants, which we did not take into account here due to our methodological constraints, were also found in the LGBTIQ corpus – and importantly in response to articles that had nothing to do with migration or LGBTIQ members of the migrant community for that matter. Quite worryingly, this appears to suggest that in some cases xenophobia has a way of entering even seemingly irrelevant discussions.

¹⁰This group of migrants is commonly referred to as ‘illegal immigrants’ in most of the comments analysed; yet, the term ‘illegal immigrant’ is strictly speaking a misnomer since Maltese Law only refers to the notions of illegal entry and illegal stay (Bugre, 2017, September).

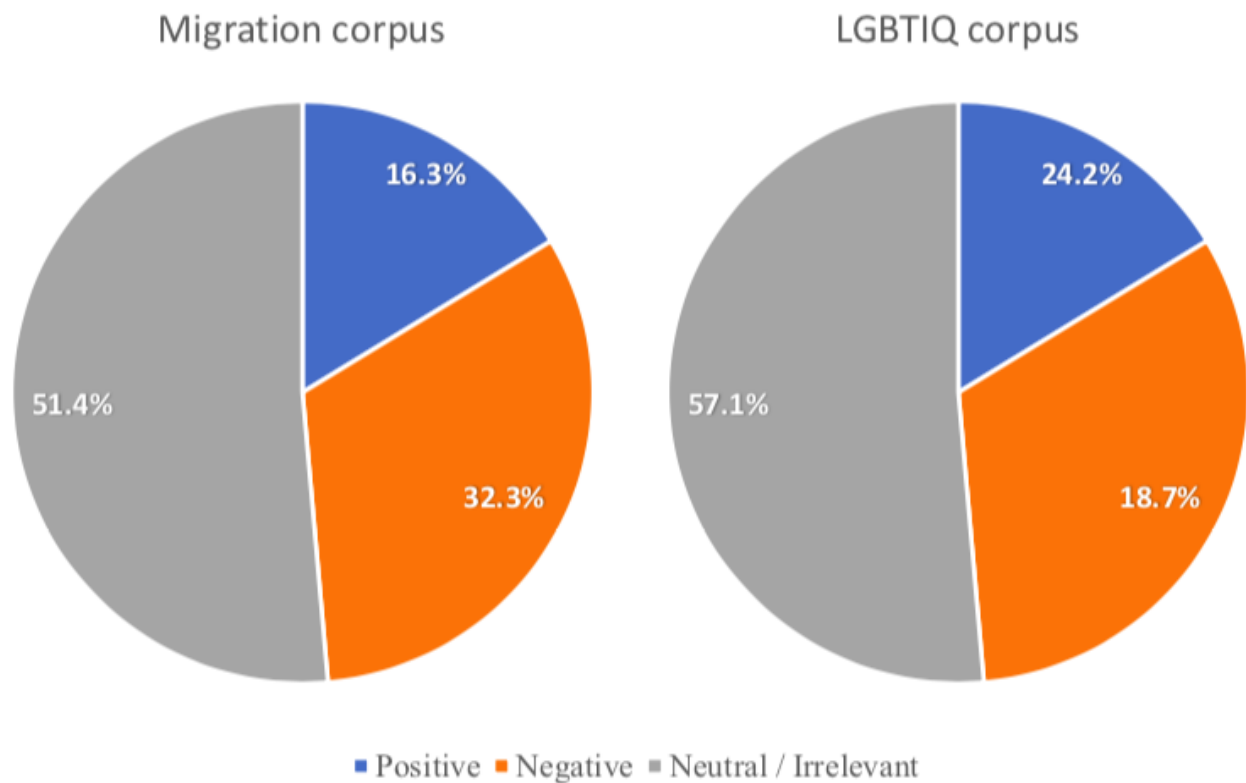


Figure 3: Polarity evaluation of sample comments.

seekers in Malta are Muslim, there is a common perception that all sub-Saharan migrants are Muslim. It becomes apparent, therefore, that there is a hierarchy of discrimination of sorts, whereby Muslims are discriminated against first and foremost, followed by sub-Saharan Africans, and that the identity higher on the hierarchy of discrimination subsumes the identities further down.

5. "...the same cannot be said for **muslim immigrants who have nothing in common with the Europeans...**"
6. "...you must also acknowledge that there is a massive difference between lets say Turkish or Egyptians Muslims and Somali or Pakistani ones. **We're not getting the right sort of Muslims unfortunately...**"
7. "...There are cultures, and then there are other cultures, which despite us not being a pure race, we never had problems with any of them, its only now that we talk about minorities, and their integration, why now, because you know damn well that **these people don't integrate. full stop...**"
8. "...Do let us **distinguish between migrants and Islam**. While we should be humane to migrants let us not forget, despite what some would want us to believe, that Islam preaches death or

servitude to ANYBODY who does not convert to Islam..."

All in all, the most common theme in the negative comments targeting migrants was the perception that they pose an imminent threat for the local population; a perception that was even explicitly expressed in some of the comments we analysed. In fact, the most pervasive metaphor in our corpus of comments was the metaphor of invasion.¹¹ As the following examples demonstrate, lexical items such as 'take over', 'over run', 'explode in numbers', 'protect ours', 'lose our culture', all contribute to the implicit metaphor that migrants are invading our land and that we need to treat them as a threat.

9. "...Beware **they are gradually taking over Malta...**"
10. "...**Do we really want this country being over**

¹¹According to Lakoff and Johnson (2003), humans perceive the world around them in terms of conceptual metaphors, which become apparent through language use. In this way we conceive of time as a forward and backward motion as evidenced in expressions like 'need to get ahead', 'fall behind' or 'move forward'. For a more detailed account of the ways in which lexical choice and metaphor can be shown to reveal discriminatory stances in the presently analysed corpus, see Assimakopoulos and Vella Muskat (2017).

run, first they want to pray where they want. What next ban bacon, ban feasts...

11. "...This is because there is an expectation that these groups will explode in numbers. **Bye bye Marsascala ghal Maltin. Persona non grata ser nispicaw...**"
12. "...we are protecting our country from losing our culture, language and most important of all – freedom..."

Turning to the axiological values that underlie comments with a negative attitude towards members of the LGBTIQ community, the most prevalent motivation for them seems to be related to religious concerns, and more specifically the assumption that these individuals lead a life that does not conform with some Divine will.

13. "...we sold our souls on ideologies that go against the word of god. There is a higher law above that of people. That of God himself, and who fears god looks at those laws not the ones on earth. Anyway there is no authority on earth that will not have to kneel in front of the only sultan. He is the only way, truth and life..."
14. "...The Bible, however, is quite clear, not just in specific passages but throughout the sacred text, that **same sex unions are disapproved by God** (i.e. God calls homosexuality "sin"), and unless God by His grace grants the homosexual repentance, the homosexual-like the adulterer, the thief, the pedophile, the liar, etc... will find himself facing the wrath of God upon death..."
15. "...that is why God left them to their filthy enjoyments and the practices with which they dishonor their own bodies since **they given up Divine truth...**"
16. "...the more they get informed about sexuality the more they want to do it. Why don't the education teach the LGBTIQI **THE NORMAL way as god wants...**"

The last comment in the examples above also shows another common conception that appears to spur negativity against the LGBTIQ community, and especially homosexuality: the idea that any deviation from heteronormative values is abnormal. In the following examples, one can see how this particular perception can give rise to comments that range from viewing homosexuality as abnormal behaviour to conceptualising it as a disease, in a metaphorical association that is regularly found in homophobic discourse (cf. Hart-Brinson, 2016). Again, drawing on the lexical make-up of the comments, lexical expressions such as 'natural', 'pretend', 'disease', 'normal function' and 'disorder' call to mind a normative value that some other belief deviates from. In addition, words such as 'organism', are neutral,

and can further contribute to a metaphor of nature and, within this context, the implication that homosexuality opposes it.

17. "...I just totally disagree with them **pretending to be normal couples...**"
18. "...Natural law makes it **impossible to equate a homosexual relationship to a heterosexual relationship...**"
19. "...**The practice of homosexuality qualifies as a "disease"** because by definition "disease is a disorder of the normal function of an organism..."
20. "...**'gay persons' Most of these people have disordered condition...**"

Still, an even more common metaphorical allusion used in negative comments towards the LGBTIQ community was that of doom, which is hardly surprising if one takes into account that most negative comments in this corpus are triggered by religious concerns in the first place. Expressions like 'hell on earth', 'bridges of hell', 'Sodom and Gomorrah' all bring to mind the sort of biblical doom that features in stories such as Noah and the great flood, Sodom and Gomorrah, and the four horsemen of the Apocalypse. This makes evident the strength of traditional Christian values on the island and the disdain of an LGBTIQ identity as something that challenges God and for which the LGBTIQ community should seek divine redemption.

21. "...Sorry to say ,but we have **HELL on EARTH...**"
22. "...**Sodom and Gomorrah alive and well in Malta!**..."
23. "...Today it's gays, then transgender, then gender fluid, then polygamy, then, then, then – **bridges to hell...**"
24. "...**degeneracy of the world, I tell you...** muh prunouns, and snowflake genders. Yep. It's tumblr-grade bullshit..."

3.2 Approximating the General Public's Perception

3.2.1 Questionnaire Responses

Turning to the first part of our perceptual study, which involved the online administration of the C.O.N.T.A.C.T. questionnaire, the respondents' evaluation of the representative examples selected from the C.O.N.T.A.C.T. corpus (see 1–6 in Section 2.2.1 above) in terms of their acceptability can be visualised as shown in Fig. 4.

It is evident from the above pie charts that our respondents were considerably more prone to accept comments expressing a negative attitude against migrants

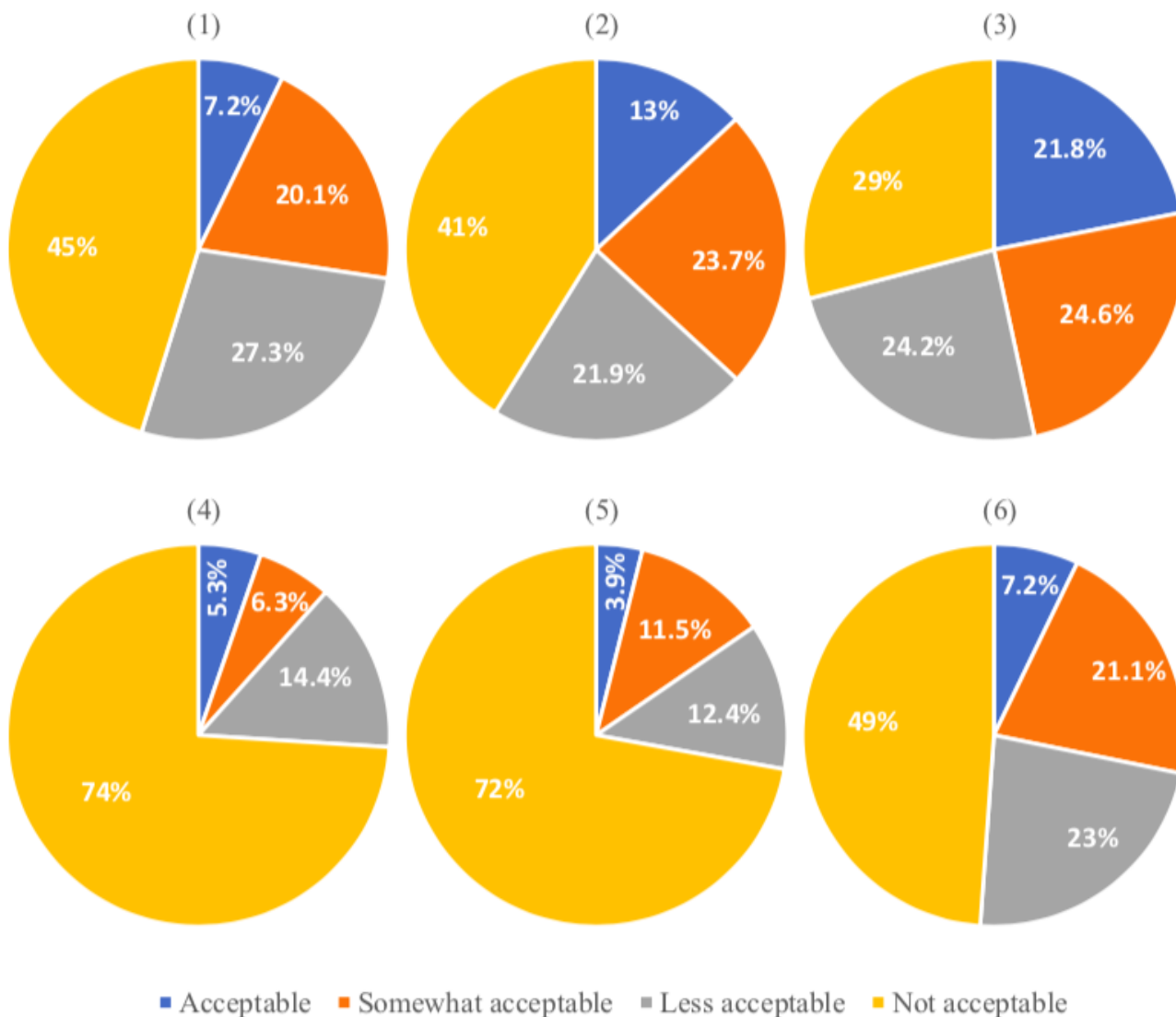


Figure 4: Evaluation of representative comments by the questionnaire respondents.

than those doing the same with respect to the LGB-TIQ community, which, in line with our qualitative analysis results, seem to suggest that, locally, sensitivity to xenophobia is nowhere near sensitivity to homophobia. Also, when asked whether their evaluation would have been any different if the relevant comments had been produced in a private context, such as in an e-mail exchange or chat or on a private Facebook page, the vast majority (79.9%) noted that this would not have made a difference to their answers, indicating in this way that their responses were, for the most part, not affected by considerations of political correctness when an opinion is publicly shared.

Still, while the responses collected from the administration of the C.O.N.T.A.C.T. questionnaire are indic-

ative of the noted trends in relation to discriminatory discourse in Malta, they are not enough on their own to provide us with a clear idea of the rationale with which our respondents provided the answers they did. To this end, we will now turn to the discussions that took place during the C.O.N.T.A.C.T. focus group interviews, as a means of probing further into the ideological background against which the local asymmetric perception of the two minority groups under study has emerged.

3.2.2 Focus Group Discussion

The conclusion that xenophobia is a far greater issue than homophobia in Malta seemed to keep cropping up during all stages of this research; it was evident both in the comment data that we analysed, as well as in

the questionnaire responses, which indicate that participants are less prone to label a xenophobic comment as unacceptable than a homophobic one. The focus group interviews provided an extra opportunity to confirm this. One participant, who is originally from a non-EU country, stated:¹²

25. *“because the first time actually I came here it was in 2009 for my studies and people were very accepting at that moment. I think that I was kind of, that’s the reason that I actually fell in love with Malta, cause I felt welcomed here and when I came back four years ago um, I actually saw, I noticed a difference here you know. People were more... less welcoming and um, there’s as well the idea of um you know the skin colour because... you are different, you look different so basically you can, actually I can actually see the difference between when they look at me or, some people I mean, and when I actually speak and I, you can actually clearly see hear my French accent and they’re like there’s something that change in the way they behave”*
(Interviewee 9, Focus Group 2)

Another, Maltese this time, participant noted:

26. *“... when I was in Edinburgh in the 90s people used to ask me... They’d often ask ‘is there racism in Malta?’ and I would say ‘well not really, but we are very homogeneous and we’re not tried and tested. Let’s wait until a situation like we have now tried and tested.’ And I have definitely witnessed... I live in St. Pauls Bay and there is an... it’s an area where you can rent for relatively cheap and there is... people will not sit next to a black guy on a bus. For example, if there’s nowhere else to sit, they might just stand. So there’s these kind of... this kind of behaviour is there now...”*
(Interviewee 13, Focus Group 3)

This highlights the perception that even when racial minorities are not faced directly with hate speech or hate crimes, they still face discrimination and exclusion on a daily basis. But the focus group discussions also revealed a number of explanations for the rather disparate perception of the migrant and LGBTIQ minority groups locally.

3.2.2.1 On the Differences Between the Two Minority Groups

During the focus group interviews, participants generally agreed that the main reason why racism is the most

¹²Much like online comments, all examples of quotations from the focus group interview participants are taken verbatim from the interview transcripts.

common form of discrimination is that unlike sexual orientation, race is something that one cannot hide. This is further complicated by the habitual conflation of racism with anti-migrant sentiments. As already mentioned previously, in Malta there tends to be widespread discrimination against migrants from sub-Saharan Africa and the Middle East. That can be attributed to the fact that Africans and Arabs from the Middle East are often visibly different from the local population – not only racially and ethnically, but also culturally, as these groups sometimes use distinct attires and follow different religious practices.

27. *“but, I think skin colour you can never hide isn’t it?”*
(Interviewee 12, Focus Group 3)
28. *“There is a lot of anti-immigrant sentiment around, I think, but then there is, does seem to be everywhere in Europe at the moment...”*
(Interviewee 4, Focus Group 1)

Moreover, racism can be seen as something that often happens in the open in Malta, and has thus desensitised people with regards to how they refer to the relevant minorities,

29. *“yeah, I do remember my landlord telling me not to leave my window open in Msida because of all the blacks there and I was just like ‘what?’”*
(Interviewee 2, Focus Group 1)

which is particularly alarming when one takes into account that racist sentiments are not limited to some particular generation, but can be seen across the board:

30. *“it is worrying ah. I’ve met university students who are rabidly, you know, far right I like to call it and you think that these students in their 20s would know better, would be a lot more progressive, but...”*
(Interviewee 4, Focus Group 1)
31. *“and, coming from the older population, you, not expect it, but you tolerate it more, but for example, I had a lecture a couple of months ago where a student said that, mmm, we were renting to some Arabs and now we have cockroaches in the flat and we will never rent to Arabs again. And you don’t exp... to see this from a university student that’s you know 26 years old, it’s surprising.”*
(Interviewee 4, Focus Group 1)

This contrasts with the use of homophobic discourse which is generally less acceptable:

32. *“I think as he said, like we assume that with sexist comments, like, people will generally accept it and*

be ok with it, um, so I guess we have this like pre-conceived notion in our minds that if we say something that is sexist like there will be nobody else that jumps in and kind of argues against. Whereas with sexist... whereas with homophobic comments, um, we're more kind of um, scared to say something".

(Interviewee 17, Focus Group 4)

Indeed, all interviewees suggested that, in their experience, homophobia has become less of an issue in recent years and provided a number of reasons for this. For one, Malta has taken large steps forward in recent years, to the point where Malta is now one of the leading countries when it comes to accepting sexual and gender minorities. As our interviewees noted, the relevant legislation changes occurred after a long and strong campaign by the Maltese LGBTIQ community, which not only exposed legislators and the general public to LGBTIQ issues and needs, but also gave the community widespread exposure. As one participant characteristically pointed out, *"nowadays because of the acceptance culture developing, we need to accept minority groups. Gay and homosexuality was at the forefront of that movement, has always been at the forefront of that movement"* (Interviewee 20, Focus Group 4). Beyond the recent exposure that the LGBTIQ community has received, however, participants also pointed out that it is becoming increasingly common to be directly related to a person of LGBTIQ or Q identity through friendship or family. Therefore, while LGBTIQ persons might indeed form part of their own minority group, they are still ultimately part of the Maltese 'in-group'. So, while, in the mind of some LGBTIQ people are still 'one of us', migrants are not and will never be:

33. *"Because you know before people used to be very conservative so basically... because my grandmother, I think that she was kind of conservative but now that in her family her grandson or granddaughters are themselves homosexual she accepts it more openly you know, even if she has a little bit of a problem, but you know, now she's open to listen, she's open to, you know, she's more open to the idea and to the idea of accepting this, you know because it's involves Maltese you know it doesn't involve somebody else living, you know I mean another person coming to the country, or another nationality you know. So that's the reason why maybe they are more accept... how do you say?"*

(Interviewee 9, Focus Group 2)

Along similar lines, another participant also attributed the rise in racism to the fact that racial minorities are quite new in Malta, which, in conjunction with the increased visibility of the LGBTIQ community, has shifted the focus towards migrants.

34. *"it's um... I think the reason is that until recently, you know, say 20 years ago, um, the country was quite racially homogeneous. People did not really talk about sexual difference much, so it would be difficult for somebody to be... It would be less likely that somebody's gonna be the target of insults."*

(Interviewee 15, Focus Group 3)

3.2.2.2 On Othering Migrant Minorities

Turning to the widespread conflation of migrants with Muslim individuals as a reason for the expression of discriminatory opinions, we were able during the interviews to ascertain why this is. The main reason seems to be related to the invasion metaphor described earlier, whereby migrants are perceived as invading the island and changing the landscape and culture.

35. *"... this is a very sensitive issue I think. Um, even for people who are, have no problems with Muslims per se, but then, when you start seeing your, I guess, people feel nervous when they see their neighbourhood being transformed um, you know, with the appearance of a mosque for instance, um, they feel uncomfortable with that. So, less people would be inclined to say, you know, that, less people would be inclined to defend immigrants who are calling for these changes."*

(Interviewee 1, Focus Group 1)

According to our interviewees, part of the fear of migrants is that they will take jobs that would otherwise go to Maltese people and will, therefore, have a negative impact on the economy and life in general. While migrants are seen as a threat to the stability of the country, LGBTIQ persons do not pose the same threat and do not have a direct impact on one's life. Although one might not agree with their lifestyle, it appears to have little effect on one's everyday existence. This is not the same for migrants, who are seen as a true threat to the Maltese way of life and stability:

36. *"I think most people in Malta, I mean with immigration, they see immigrants like 'ah they're taking what's ours' so that's why it effects. Like you said I mean homophobia's just a mind-set 'I don't accept you' or 'I accept you' and it doesn't really affect me in general. I mean some people are uncomfortable by it, I don't know why, but I mean it's, they're not taking something away from them."*

(Interviewee 6, Focus Group 2)

Then, it was also pointed out that this is not a product of Maltese mentality alone. Mainstream political discourse plays a role and reinforces the sort of xenophobic discourse often used to speak about ethnic, racial, and

religious minorities, and in particular African, Arab and Muslim migrants. In contrast, the mainstream media further strengthens the general positive stance toward the LGBTIQ community. Hence, most people are far more exposed to negative discourse towards migrants, and thus less likely to rate it as unacceptable:

37. *“But the mainstream political discourse on the subject of multiculturalism and immigration actually reinforces racism.”*

(Interviewee 15, Focus Group 3)

Evidently, multiculturalism is a hot issue that has been widely debated in recent years. Some argue that multiculturalism and acceptance of various cultures can contribute to a society where diversity is not only respected, but also embraced, and where people of different backgrounds can come together to live in a colourful society of various languages, practices, religions, and even cuisines. On the other hand, others argue that multiculturalism is not possible and creates animosity and distress to those living in such a society. Hence, within the scope of multiculturalism, there appeared to be a general tendency in the focus group interviews to defend opinions that were taken to be protecting the Maltese culture. In this view, multiculturalism might not be negative by virtue of what it stands for; what makes it particularly negative is its ability to push aside the Maltese culture as the dominant and most visible culture of the country. As one participant put it, while giving their opinion about the low acceptability rating received for one of the comments, *“in the other one he’s attacking directly the people rather than just analysing the situation from a ‘I want to protect my culture’ point of view”* (Interviewee 20, Focus Group 4). As this remark suggests, it may be considered less acceptable to directly attack a person on the basis of a minority identity, but if one is trying to defend and protect one’s culture, it is more acceptable to use such rhetoric.

Finally, when discussing African, Arab, and Muslim migrants as opposed to migrants from Western and Northern Europe, the issue that came out most prominently was that of assimilation and integration. Participants pointed out that while African, Arab, and Muslim migrants often face discrimination in Malta, migrants from Western and Northern Europe do not generally face the same intolerance. According to most interviewees, it was because of this that the participants of the questionnaire might have been less likely to rate Islamophobic or racist comments as overtly negative. In other words, Western and Northern Europeans seem to ‘blend in’ *“because it’s easier for them to assimilate”*, whereas African, Arab, and Muslim migrants stand out both physically and culturally, when the Maltese *“expect them to assimilate, not integrate”* (Interviewee 3, Focus Group 1). In fact, the common perception seems to be

that Western and Northern European migrants have a very similar culture to that of the Maltese:

38. *“because they’re the same, I think because, maybe in terms of culture, there’s a lot more similarity between a Maltese and a European.”*

(Interviewee 1, Focus Group 1)

3.2.2.3 On Othering LGBTIQ Minorities

Honing in on the LGBTIQ community now, even though the general public is less willing to accept homophobic discourse, our analysis has already shown that at least some negativity still exists in Malta. In this regard, in line with the linguistic analysis of the relevant comments, and the prevalent metaphor of doom, our interviewees pinpointed a main reason why this might be. It was thus noted that people might be less inclined to mark a comment as discriminatory if that comment somehow involves the church. In other words, if the comment is in line with the church’s doctrine, the comment must be right, or at the very least, make sense:

39. *“Perhaps as well, the last one, the third one is more acceptable to people because it’s, the context is less religious. The other two are religious stories, the first one about the church’s commission, and the second one about um, the Dominican order, but the third one is about legislation, so it may be that um people find it more acceptable. . .”*

(Interviewee 4, Focus Group 1)

What this effectively suggests is that people are less willing to accept discrimination against LGBTIQ persons on the basis of legislative freedoms than they are on the basis of religious argumentation.

4 Conclusion

The central finding of the research reported in this paper has been that xenophobia appears to be a far greater issue than homophobia in the Maltese context. Even within the domain of discourse about migrants, however, there is a particular subset of the relevant population that seems to be the main target of discriminatory attitudes; a group that is characterised by its Muslim faith and an Arab or African ethnic origin. What is particularly notable, in view of our analysis as well as the discussions that arose during the focus group interviews, is that there is also a widespread tendency to confound religion with ethnicity, with instances of both Christians being categorised as Muslims because of their skin colour and Muslims being categorised as Arab/African by virtue of their faith alone. This local prevalence of xenophobia in comparison to homophobia can also be discerned in the existence of far more discriminatory comments pertaining to migrants than members of the

LGBTIQ community in our sample analysis, as well as in the tendency of our survey participants to find xenophobic remarks more acceptable than homophobic remarks that were commonly marked as completely unacceptable. This latter point can even be seen in the following comment that was actually left as feedback in the questionnaire by one of our respondents: “*The proliferation of immigrants and their culture is generating fear as well as inconveniences in some areas in Malta and reprisals are sometimes understandable.*”

Turning to the quite prominent positive attitude towards members of the LGBTIQ community, as we have seen, this has been attributed by our focus group interview participants to the inclusion of the relevant group in the Maltese in-group. Additionally, the role that recent legislation on LGBTIQ rights has played in this vein could also be a contributing factor; after all, as already noted above, Malta was the only country in the C.O.N.T.A.C.T. consortium where the positive stance towards the LGBTIQ minority was higher than the negative one in the online comments analysis, when it also ranks first in legal and policy human rights of LGBTIQ people in Europe (ILGA-Europe, 2016). Even so, some negativity, predominantly connected to religious concerns, still lurks in the background.

All in all, this article adds to the growing body of literature which suggests that the discursive strategies employed in discrimination are not always made explicit by speakers. By means of an in-depth critical discourse analytic investigation, we have shown that the underlying ideologies of these strategies can be exposed. In this way, the relevant research can go beyond the mere investigation of the language of discrimination and uncover the values and beliefs that are imbued within it. That said, a caveat is in order: while research of the sort that is pursued in this study is revealing, it cannot, in this particular context, make any claims as to whether or not the identified implicit markers of ideology are used consciously by the commenters at hand. Instead, it provides insight into the intricate relationship between language and ideology as well as various systems of belief. And to the extent that the results obtained through the perceptual study allows us to do so, we believe to have indeed shown that critical discourse analysis is a worthwhile venture that goes beyond the study of linguistic structure and can have far-reaching sociological and political implications.

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Maltese Study of Intracranial Vascular Malformations

Theresia Dalli*¹, Charmaine Chircop¹ and Maria Mallia¹

¹Department of Neuroscience, Mater Dei Hospital, Msida, Malta

Abstract. Intracranial vascular malformations (IVMs) are responsible for 49% of spontaneous intraparenchymal brain haemorrhage in patients under 40 years of age. IVMs may cause recurrent intracranial bleeds, focal neurological deficits, seizures and chronic disability. The aim was to study the incidence of arterio-venous malformations (AVMs) and cerebral cavernous malformations (CCMs) in the Maltese population, assess mode of presentation, patterns of interventions, outcomes and follow-up of the lesions. A word search through the radiology information system was carried out, identifying cases of IVMs between 2008 and 2016 at Mater Dei Hospital. Brain or dural AVM, carotid-cavernous fistulae and CCM were included in the study. A participant was identified as the “incident” case at the time of the first diagnostic image. Interventions, follow-ups and complications were noted. 47 patients had AVM and 35 had CCM. The majority of patients with AVM presented with headaches. MRI was the prevalent imaging modality used at diagnosis. 42.6% of patients received radiosurgery. Haemorrhage was the commonest complication. In the CCM group, seizures and focal signs were common presenting symptoms. 65.7% of patients with a CCM were followed-up with further imaging within one year of diagnosis. The majority of patients received no intervention. IVMs may cause significant morbidity in patients and timely recognition is essential. The risk of haemorrhage in patients with AVMs is 1–4% per annum and this risk directs management. Presently, decisions regarding CCMs are made on a case-by-case basis. There is a need for guidelines, to help direct clinicians on the evidence-based management of IVMs.

Keywords: intracranial vascular malformations, arteriovenous malformation, cavernoma, cavernous malformation

1 Introduction

Intracranial vascular malformations (ICM) are abnormalities in the cerebral arterial and venous systems and can incorporate a vast number of vascular lesions that have differing structure, haemodynamics and prognosis. While some might be life-threatening, such as arteriovenous malformations or a vein of Galen aneurysmal malformation, others might be found incidentally and might remain asymptomatic throughout a patient’s lifetime. ICMs are sub-classified into those malformations that occur in the presence of shunting such as arteriovenous malformations (AVMs) and arteriovenous fistula (including dural arteriovenous fistula, dural sinus malformation and vein of Galen aneurysmal malformation) and those which occur in the absence of shunting such as cavernoma and venous malformations.

These ICMs are responsible for over a third of spontaneous intraparenchymal brain haemorrhage in patients under 40 years of age (Ruíz-Sandoval JL & Barinagarrementeria, 1999) hence, making them the leading cause of haemorrhage in this age group. Lesions might be found incidentally or the patient might present with persisting headaches, global or focal seizures, upper motor neurone signs and rarely death due to a significant intraparenchymal bleed. They may be the cause for recurrent intracranial bleed, focal neurological deficits such as hemiplegia, seizures and chronic disability. While therapeutic interventions such as radiosurgery, surgical excision and embolization can be useful in alleviating symptoms in a number of patients, there remains uncertainty on the prognosis such malformations carry in certain individuals and on the clinical course of untreated IVMs.

The aim of the study was to study the incidence of AVMs and cavernomas in the Maltese population, assess their mode of presentation and outcomes. Patterns of interventions and modes of follow-up of lesions were also noted. Outcomes of patients who did not receive inter-

*Correspondence to: Theresia Dalli (theresia.dalli@gmail.com)

ventional treatment were also monitored shedding light on the beneficial and adverse effects of the used interventions. Moreover, there haven't been any publications with regards to the incidence of these malformations in the Maltese islands and thus this study is the first published population based study shedding light into the presentation and outcomes of these patients.

2 Materials and Methods

A word search through the radiology information system was carried out, identifying cases of intracranial vascular malformations between January 2008 and October 2016 which were diagnosed at Mater Dei Hospital. Search criteria included cavernoma, cavernous malformation, AV¹ fistula, arteriovenous +/- malformations, AVM/s, AV fistula and arteriovenous fistula. Fistulas or AVMs occurring elsewhere in the body including renal, bladder, trunk or abdomen were excluded from the study. Patients included in the study were aged 14 years or over at the time of diagnosis. Any patient with a brain AVM, dural arteriovenous AVM, including carotid-cavernous fistulae and cavernous malformation with or without a venous malformation diagnosed between 2008 and 2016 were included in the study. Vein of Galen aneurysmal malformations were included in the study yet all other aneurysms were excluded. A participant was identified as the "incident" case at the time of first diagnostic image being it CT² (including CT Angiogram), MR³ (including MR angiogram) or catheter angiogram. Patterns of intervention were then monitored including both observational and surgical treatment. Any complications noted at the time of diagnosis or subsequently were then documented and analysed.

3 Results

There were 82 patients included in the study, out of which 47 had AVMs and 35 had a cavernoma as shown in Table 1. The incidence of newly diagnosed AVM in the Maltese Islands between 2008 and 2016 was 0.01% whilst that of cavernomas was 0.008%.

The mode of presentation of both AVM and cavernoma are as shown in Fig. 1. The commonest presentation with regards to AVMs was with headaches (28%), followed by neurological deficit (21.3%) and seizures (17%). 26% of AVMs were diagnosed incidentally in comparison to 43% of cavernomas. Symptomatic cavernomas presented mostly with seizures (20%) and neurological deficits (20%) with only 17% presenting with headaches.

MRIs were the commonest imaging modality used at the time of diagnosis of an AVM (47.8%) followed by MR Angiography (23.4%) and CT Scans (including CT An-

¹AV – arteriovenous

²CT – computed tomography scan

³MR – magnetic resonance

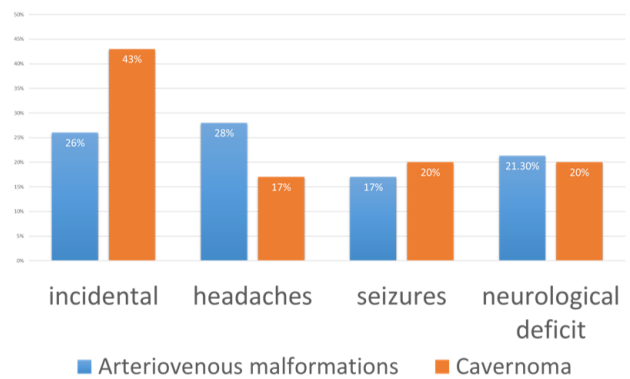


Figure 1: Mode of presentation of ICM. Headaches were the commonest complaint in the AVM subgroup whilst most cavernoma were diagnosed incidentally.

Location of Lobar AVM

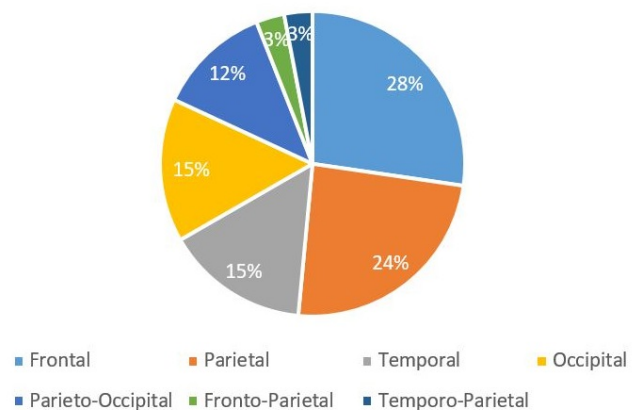


Figure 2: Location of lobar AVM. 70.2% of AVMs were lobar with the commonest areas affected being the frontal as can be shown in Fig. 2. 23.4% of AVMs were deep and 6.4% were cerebellar. AVMs in deep locations were located in the thalamo-capsular region over the corpus callosum, brainstem, floor of the fourth ventricle, basal ganglia, thalamus, the splenium of the corpus callosum and the floor of the middle cranial fossa.

giogram). 51% of patients diagnosed with an AVM, had a cerebral angiogram of which 87.5% took place prior to therapeutic interventions, be it excision, radiosurgery or embolization. Thus, 61.7% had follow-up imaging within a year since diagnosis, 70.2% of AVMs were lobar with the commonest areas affected being the frontal as can be shown in Fig. 2, 23.4% of AVMs were deep and 6.4% were cerebellar. Size was documented in 46.8% of cases where an AVM was detected.

82.8% of cavernomas were diagnosed on MRI (including MRA) with only 8.5% being diagnosed using a CT (including CT Angiogram). 54% of the cavernoma were lobar (as shown in Fig. 3), 43% were deep and 3% were cerebellar. In 80% of cases, dimensions of the

Table 1: Demographic data of patients participating in the study. The AVM and Cavernoma subgroups showing the number of male and female participants. The mean age at the time of diagnosis based on the gender is shown.

	AVM	Mean age at diagnosis of AVM	Cavernoma	Mean age at diagnosis of cavernoma
Male	29	44.89	12	56.42
Female	18	40.44	23	42.00

cavernoma/s were included in the radiological report. 65.7% of patients were followed-up with some form of imaging modality within one year of the diagnosis.

Management of IVM is made on a case-by-case basis. Fig. 4 shows a summary of the interventions offered to patients diagnosed with an ICM.

Location of Lobar Cavernoma

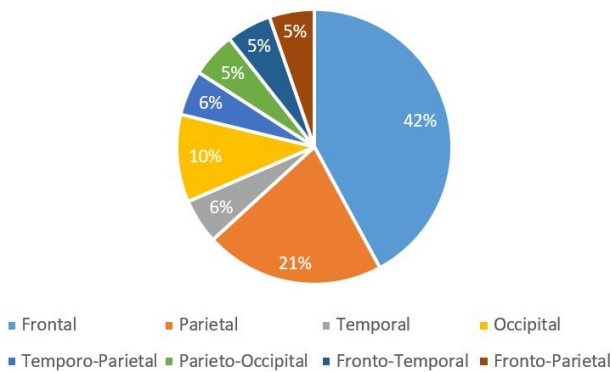


Figure 3: Location of lobar cavernoma. 54% of the cavernoma were lobar, 43% were deep and 3% were cerebellar. Deep seated cavernoma were located in the centrum semiovale, pons, lentiform nucleus, adjacent to the ventricles, basal ganglia, mid-brain, thalamus, periventricular area, hippocampus and medulla.

The most common complication in both subgroups is haemorrhage with 36.2% of patients with an AVM suffering a bleed either at the time of presentation or during the period of follow-up. In comparison, 37.1% of patients with a cavernoma had a bleed wither at presentation or thereafter. Seizures and progressive neurological deficits were commoner in the AVM subgroup in comparison to the cavernoma subgroup, as can be seen in Fig. 5. Interestingly, no statistically significant increase in complications was noted between patients who were regularly followed-up with imaging but never received a therapeutic intervention and those who received some form of intervention. A *p*-value of 0.09 was obtained when comparing haemorrhage rates between the afore mentioned sub-groups, a *p*-value of 0.48 when comparing seizures and a *p*-value of 0.62 when comparing the rates of progressing focal neurological signs.

Out of the 35 individuals who were diagnosed with a cavernoma, 8.6% were diagnosed with multiple lesions affecting both sides of the brain.

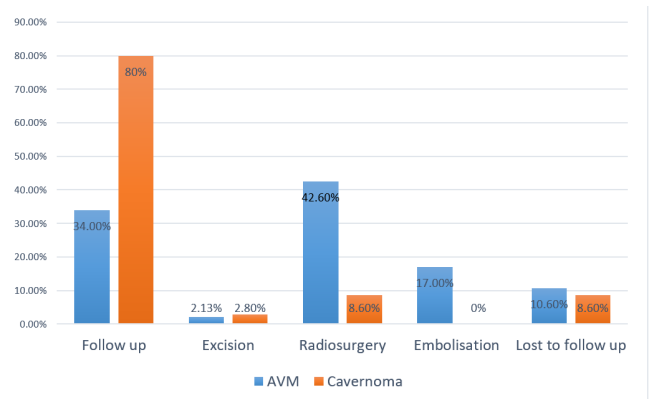


Figure 4: Management of ICM. 42.6% of patients with an AVM had radiosurgery with the commonest modality used being Gamma knife. Cyberknife and stereotactic radiosurgery were other modalities used. This is in contrast to the cavernoma subgroup where a minority of 8.5% were treated with Gamma knife radiosurgery. A single patient was offered debulking surgery.

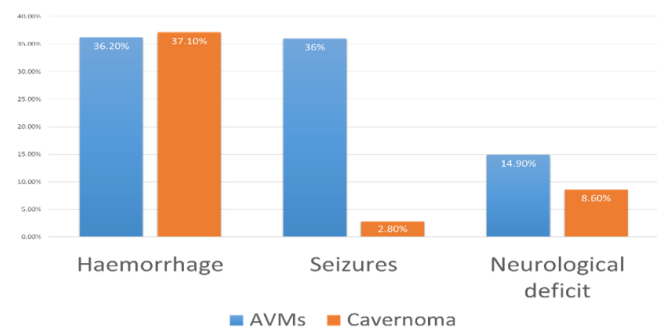


Figure 5: Complications of ICM. 36.2% of patients had haemorrhage as a complication of the AVM of which 82.4% had it at presentation and 17.6% had multiple episodes. In 11.8% of cases where haemorrhage was documented, the haemorrhage was the cause of death. This is in contrast to cavernomas where 37% of patients had haemorrhage with up to 75% of these having the bleed at presentation.

4 Discussion

4.1 Arteriovenous Malformations

Intracranial AVMs are a relatively rare occurrence and are typically congenital vascular anomalies. They are composed of complex connections between arteries and veins without any intervening capillary bed. The veins are typically tortuous and dilated secondary to the high velocity of the blood flowing through the fistula. Some conditions linked to intracranial AVMs include Sturge-Weber disease, Osler-Weber-Rendu syndrome, von Hippel-Lindau syndrome and neurofibromatosis (International RadioSurgery Association, 2009). Mohr, Kejda-Scharler and Pile-Spellman (2013) suggest an incidence of AVMs of 0.1%, whereas that in the Maltese population was found to be 0.01%.

Although the AVMs are typically congenital, patients typically present in early adulthood between the ages of 20–40 (Fleetwood IG, 2002). Seizures or brain haemorrhage may occur in the younger and elder population as an incident event. Up to 66% of adults who have been found to have an AVM might also have a history of subtle learning disorder (International RadioSurgery Association, 2009). Presentation can be varied with headaches, seizures, progressive neurological deficit or brain haemorrhage being the commonest mode of presentation. Indeed many AVMs are identified once there is sudden onset of bleeding that can merely lead to a headache with or without any neurological signs or can be fatal. Deep seated AVMs are the most likely to present with haemorrhage. Bleeding can occur into the brain parenchyma, subarachnoid space or the intraventricular space. Patients with an AVM carry an annual risk of 1–4% of getting an intracranial bleed (Fleetwood IG, 2002) with particular angiographic features, such as, small/deep venous drainage and high pressures of the arterial and venous components of the AVM nidus increasing the chance of bleeding further. Previous rupture, as well as, young age are other predictors of increased risk of bleeding. The risk of bleeding is highest in the first 5 years after diagnosis yet it remains significant for decades (Laakso et al., 2008).

Headaches are the commonest presentation of AVMs. The headaches can be typical for migraines, especially if the AVM is a subcortical lobar one, or can present with non-specific generalised headache. Seizures can be both focal or secondary generalised in nature. Progressive neurological deficits may be a presenting feature if the AVM is enlarging or if there is high pressure in the draining vessels causing a mass effect. In the absence of the mass effect, progressive neurological deficits can occur secondary to the ‘steal phenomenon’, where blood is syphoned away from the adjacent brain parenchyma into the AVM nidus (International RadioSurgery Association, 2009).

High-resolution neurodiagnostic imaging is indicated in patients presenting with any of the symptoms common to AVMs. Magnetic resonance imaging with cerebral angiography is required to identify AVMs. Cerebral angiography helps to assess the haemodynamics and the morphology of the AVM, which are essential when planning treatment. Important features include the presence of any arterial or venous aneurysms within the nidus of the AVM, which increase the risk of rupture, the venous draining patterns and the feeding vessels (International RadioSurgery Association, 2009).

Management of the AVM depends on the nature of the AVM, risk of subsequent bleeds and any co-morbidities. There are four management strategies: observation, endovascular embolization, stereotactic radiosurgery and surgical excision. Observation may be ideal for patients with large volume AVMs, especially if there has never been an episode of bleeding. Endovascular embolization is typically used as an adjunctive therapy prior to surgery and can only be used if a part of the AVM nidus can be obliterated successfully. Stereotactic radiosurgery is recognised for AVMs that cannot be resected. Depending on the patients’ age, AVM location, size and underlying comorbidities one can opt for Gamma knife radiosurgery, linear accelerators or proton beam therapy (International RadioSurgery Association, 2009).

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4.2 Cerebral Cavernous Malformations

Cerebral cavernous malformations (CCMs) are a collection of atypical blood vessels through which blood flow is sluggish. They are rarer than AVMs with an incidence of 0.4–0.8% (Mouchtouris et al., 2014). In our study, the incidence was of 0.008% which was significantly less than that for AVMs and also lower than that in published data.

CCMs carry a risk of haemorrhage as blood tends to leak through the inter-cellular junctions making up the walls of the cavernoma (Samarasekera et al., 2005). Most cavernomas occur sporadically however, some have been noted to be inherited in an autosomal dominant pattern with mutations in the CCM1, CCM2 and CCM3 genes being linked to such inheritance. Studies have shown that in adults with a single cavernous malformation but with no family history the chance of a mutation is up to 1% whilst in adults who have at least one cavernoma and a positive family history, the chance of a mutation being present is between 78–94% (D’Angelo et al., 2011; D. L. Verlaan, Laurent, Rouleau & Siegle, 2004; D. J. Verlaan et al., 2004). Hence, it is recommended that in patients with a cavernoma and a positive family history, investigations are carried out to check for mutations in CCM1 - 3 genes.

Cavernomas, like AVMs, can present with intracranial bleeding, epileptic seizures and focal neurological signs.

The annual risk of an intracerebral bleed in someone who has been diagnosed with a cavernoma that has never bled is between 0.4% and 0.6%. The percentage increases to between 3.8% and 22.9% if the cavernoma has already leaked (Al-Shahi, Berg, Morrison, Awad & Angioma Alliance scientific advisory board, 2008). The risk of a second bleed decreases over time (Fleming, Link, Christianson & Brown, 2012). Patients who present with a first seizure have a risk of 94% of developing epilepsy in the first five years from the time of diagnosis (Samarasekera et al., 2005).

Diagnostic imaging using T1-weighted and T2-weighted MRI together with haem-sensitive sequences is recommended in order to diagnose cavernomas and assess whether they are solitary or multiple. It is also recommended that in patients who have a brain mass accompanied by substantial amount of blood and vasogenic oedema an assessment for the presence of a CCM is carried out. Decisions regard whether patients should be followed up with imaging or whether to refer for radiosurgery should be done on a case-by-case basis as there are currently no guidelines (Samarasekera et al., 2005).

5 Conclusion

IVMs can cause significant morbidity and mortality in patients and hence, their detection and follow-up is essential. Data from this study suggests that incidence in Malta is comparable to that overseas and that patients are managed in a similar fashion albeit decisions are taken on a case-by-case basis. A limitation of the study was that death certificates were not looked into and thus any IVMs that might have caused sudden death were missed.

Documentation of size is essential as well as details regarding the feeding and draining vessels and the location of any malformation as these might affect the clinicians' decision to offer therapeutic intervention and might affect prognosis. While the studies performed in the area indicate the potential dangers of these ICMs, there is a lack of consensus among clinicians on how to proceed once an ICM has been detected. This raises the need for a guideline, which would help direct clinicians as to when follow-up scans should be undertaken and at which point interventions should be offered to their patients.

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Research Article

An Analysis of Trade Union Membership in Malta

Manwel Debono*¹

¹Centre for Labour Studies, University of Malta, Msida, Malta

Abstract. Despite their crucial social role, trade unions in Europe are suffering from challenges relating to a widespread trend of declining membership levels. Public information on trade union membership levels in Malta is mainly obtained from reports compiled annually by the Department of Industrial and Employment Relations through administrative records provided by the trade unions. This study, the first of its kind in Malta, offers an alternative and more detailed examination of membership levels through a survey carried out among a representative national sample of 781 employees. This study reveals a lower trade union membership level than what is officially reported. In line with foreign research, this study also indicates that the likelihood of being a trade union member increases among older employees, those who are in full-time or indefinite contracts, and those employed in the public sector. On the other hand, contrary to European trends, employees holding tertiary qualifications and higher level occupations are more likely to be unionised in Malta. Besides, male and female employees are equally likely to be unionised. This study concludes that, in order to prevent further decline in trade union density and membership, Maltese trade unions need to reorganise themselves, refocus their strategies and become more effective in attracting and retaining non-traditional members.

Keywords: Trade unions, density, membership, socio-demographics, survey, Malta

1 Introduction

Free trade unions play a crucial role in a democratic society. Trade unionism is widely credited for having improved the working conditions of employees around the world through collective bargaining and by influencing public policy. However, “trade union influence extends beyond the confines of the workplace and impacts upon

society as a whole, making a key contribution to creating, maintaining, and rebuilding democratic societies” (Fick, 2009, p. 249). “Trade unions are often the only institutions that give a voice to workers, whose circumstances are often neglected by those in power. More important still, sometimes they are the only mass-based organisations that stand against authoritarian regimes” (Craner, 2002, July 18, para. 5). Fick (2009) argues that the strategic social importance of trade unions derives from the following five attributes. They are based on democratic principles, comprise heterogeneous membership (in terms of sex, age, social background and so on), are financially independent from governments and private interests, have a broad range of concerns extending beyond the workplace, and occupy a mid-level placement within the social pyramid, thus having access to both political and economic elites and their grass roots constituencies.

The European Union and governments across Europe hold trade unions as important social partners which are consulted in key decision making fora. Bryson, Ebbinghaus and Visser (2011, p. 104) note that “in large parts of Europe... unions are strongly embedded in social, political and economic structures which help sustain them and provide a strong foundation for their influence in society”. Yet, the same policies and forces that are pushing towards economic growth in Europe might be undermining trade unions. Economic, social, technological, legal and other contemporary changes affecting the labour market are offering increasing challenges to the trade union movement. Hyman (2007) mentions three major challenges facing trade unions, namely “economic internationalisation [which] makes it easier for employers to escape national structures of employment regulation, and appears to weaken the ability of governments to defend nationally-based social models; sectoral and occupational shifts in employment [which] erode traditional union strongholds, while social and ideolo-

*Correspondence to: Manwel Debono (manwel.debono@um.edu.mt)

gical changes undermine workers' traditional orientation to collectivism" (p. 193). Many trade unions are losing their traditional membership base (Jensen, 2006) and struggle to maintain their *raison d'être*. It has been argued that trade unions might be gradually losing both their influence and relevance (e.g. Pech, 2005; MacShane, 2001).

Trade union membership is a major - though not the only - indicator of trade union strength, influence and relevance (Bryson et al., 2011). For instance, during its policy making process, the European Union consults trade unions that represent most employees in specific economic sectors. In Malta as in other European countries, the 'largest' unions (meaning those with most members) are represented on important Government fora and consultative bodies that may directly affect national policy and legislation. Thus, unions exert considerable effort to try to maintain and if possible improve their membership levels. But in order to do so effectively, it is important to understand the determinants of trade union membership. As will be discussed further down, international research examined a host of factors that may influence the likelihood of union membership. However, are such factors relevant in Malta, due to the country's distinct development of its industrial relations system and its particular socio-economic characteristics?

The aim of the study is to shed more light on trade unionism in Malta through a critical discussion of the results of a survey undertaken among a representative sample of employees, a methodology which has never been used in this country for such a target population. This study compares declared individual union membership figures with the official membership data sent by unions to the Registrar of Trade Unions (RTU). Besides, it examines the relationship between a set of socio-demographic variables highlighted in foreign research and the likelihood of union membership. The following section explores trade union density in Malta.

2 Trade Unionism and Membership Density in Malta

Over the years, trade unions have been a major social force in Europe. However, since 1975, there has been a steady decline in trade union density across Organisation for Economic Co-operation and Development (OECD) member states, including European ones (OECD, 2018). The general trend of decreasing trade union density and also raw membership across the European Union is very clear, despite methodological difficulties in its calculation (Carley, 2009). Indeed, the European Foundation for the Improvement of Living and Working Conditions refers to this as a 'megatrend', with only a few countries registering stable

figures (Eurofound, 2015). It is clear that Northern European countries tend to be more heavily unionised than Southern ones. The countries' varying trade union densities are indicative of the absence of a single cohesive trade union system in Europe. Some researchers have found it useful to group countries according to their geographic location, in order to categorise the various trade union realities in Europe (e.g. Bernaciak, Gumbrell-McCormick & Hyman, 2014; Jensen, 2006).

Due to its geographic location in the middle of the Mediterranean Sea, one may be tempted to classify Malta's trade union movement within the group of Southern European countries. Indeed, the country's trade unions have some similar characteristics to this group, such as being divided according to political ideologies and being very active at policy level. Malta's culture has been especially affected by the close proximity to Italy. However, in contrast to several Southern European countries, the legal foundation of industrial relations has traditionally been rather weak, and Malta's industrial relations are regulated in large part through collective bargaining; collective agreements are estimated to cover between 50% and 61% of all workers (Debono, in press; Grech, 2013). The trade union movement in Malta is dominated by two general trade unions, and all collective agreements in the private sector are concluded at enterprise level. These latter characteristics place Malta within the Anglophone group of countries. Having been a British colony for some 160 years, most of Malta's institutions, including trade unionism, were originally developed on the British model. The unions' traditional confrontational approach towards employers appears to derive from such influence. However, with Malta's independence from Britain in 1964 and its accession to the EU forty years later, a gradual shift away from some British elements towards continental Europe has emerged. For example, governments have increasingly facilitated social partners' participation in policy formulation. Over the last decade, industrial relations were also affected by the European economic crisis. Unions became perceptibly less confrontational and industrial action has decreased substantially, making space for more dialogue with employers (Debono & Baldacchino, in press).

Traditionally, trade unionism in Malta flourished among blue-collar workers, starting in the Malta Drydocks and continuing in the manufacturing sector. Indeed, the General Workers' Union (GWU), which is by far Malta's largest union (representing about half of all unionised workers in the country), has over the years primarily supported blue-collar workers and their families. The union has since its foundation adhered to a leftist ideology, publicly backing the Labour Party in its early years and having been statutorily fused

to that party during 1978–1992. The Union Haddiema Magħqudin, Malta’s second largest union (representing about a quarter of all unionised workers in the country) grew in part as a Christian democratic counterbalance to the GWU: it tends to lean to the right of the political spectrum and attracts mostly white-collar workers as its members. It is important to note here that, despite the ideological stances of these two general unions, Maltese workers appear to be motivated to join unions mostly for instrumental rather than ideological reasons (Zammit & Rizzo, 2002; Debono, 2017).

The only source of trade union membership data in Malta is that compiled by the Director of the Department of Industrial and Employment Relations (DIER) in his/her capacity as Registrar of Trade Unions. The Employment and Industrial Relations Act (EIRA) (Government of Malta, 2002) specifies that trade unions are required to send their annual membership figures to the Registrar in June. Such data is then compiled and published in the Government Gazette. Failure to comply with such procedures may result in the cancellation of the union from the register. In order to derive density, trade union membership figures are compared to employment data. Different studies have used different procedures to carry out such comparison. Thus, while Malta’s trade union membership figures are similar across all studies (since they derive consistently from one and the same source), density figures tend to vary. A main source of divergence derives from which of two types of employment data is used. Official employment data is often based on the Labour Force Survey (LFS) that has been compiled for nearly 20 years. However, there exists another type of data based on administrative records held by the Malta’s public employment service, which relies on the formal registration of workers, and which goes back at least to 1950. The latter does not tally with LFS figures since they are based on different data-gathering methodologies. In fact, the use of the LFS results in considerably lower density levels. Another source of discrepancy in density figures derives from whether one compares ‘gross’ or ‘net’ membership densities (Baldacchino & Debono, 2009). The reported density figures are often based on ‘gross’ calculations, deriving from simple ratios between overall membership and employment figures. However, net densities are sometimes used. These are based on more precise calculations and exclude from the equation such factors as union members who are pensioners, students, self-employed, unemployed persons, and workers who are legally prevented from joining trade unions (Baldacchino & Debono, 2009). This more realistic measure reveals higher trade union densities in Malta between 1953 and 2008 (Baldacchino & Debono, 2009). With a net density of 59.3% in 2008 (Baldacchino & De-

bono, 2009), Malta ranked among the European Union countries with the highest membership densities, close to the Nordic cluster. More recent comparative data from the ICTWSS Database (Visser, 2016) indicates a lower union density of 52.9% in 2012 (the methodology used is unknown) but this still gives Malta the fifth highest density in the EU. The latest density recorded in Malta is about 58% in 2017 (using administrative employment data and excluding pensioners who are trade union members) (Debono, in press).

While the above figures indicate Malta’s trade union density to be between 53% and 58%, this might be overstated. Doubts remain as to the accuracy of RTU figures (Baldacchino, 2007, May 20) which rely on trade unions’ own membership declarations; as mentioned in the introduction, unions have an interest in brandishing strong membership figures. Besides, RTU figures do not consider the phenomenon of workers who are paid-up members of more than one trade union, and who may thus artificially inflate the overall trade union density in Malta. Considering the importance of density figures, often used as the main indicator of unions’ performance, this study aims to investigate the veracity of official statistics. It is hypothesised that the trade union density computed through a survey method will be considerably lower than what is normally reported.

The following section examines research linking socio-demographic variables with trade union membership, while taking into consideration the situation in Malta.

3 The Relationship Between Socio-Demographic Variables and Trade Union Membership

International literature links trade union membership with socio-economic, political and work-related aspects, personal characteristics and attitudes (Schnabel & Wagner, 2007). This section explores how gender, age, education, occupation, employment sector and economic activity may relate to unionisation by examining the changing socio-demographic characteristics of trade union membership in Europe and the likelihood of unionisation.

3.1 Gender

Gender has probably been studied more than any other socio-demographic variable in relation to unionisation in Europe (e.g. European Trade Union Confederation, 2002; Schnabel & Wagner, 2007; Ledwith, 2012; Eurofound, 2014). Women are less likely to be unionised than men (Checchi, Visser & Van De Werfhorst, 2010) and, despite lacunae in data, trade union membership in Europe is clearly male-dominated Carley (2009). Only in around 30% of the main trade union organisations (for which data was available) do women outnumber men;

while, in aggregate terms, about 43% of trade union members in the studied organisations are women (Carley, 2009). However, when one compares the last figure with the fact that around 46% of those in the labour force are women (Eurostat, 2018), then the gender imbalance in union membership appears to be small. It is also worth noting that in some Nordic countries, women have a significantly higher probability of being unionised than men (Schnabel & Wagner, 2007). Indeed, women comprise the majority of trade union members in Baltic and Nordic countries, as well as Poland (Carley, 2009). In most of these countries, women are especially dominant in white-collar unions. This reflects the fact that the majority of white collar workers in these countries tend to be women (Eurostat, 2018). Women are also particularly present in some countries in public sector unions, which again tends to reflect the fact that women might be more likely to work in the public sector than men. The gender difference in unionisation “has traditionally been interpreted as a reflection of men’s greater degree of attachment to the labour force which would increase the benefits of unionisation both from the point of view of employees and of unions” (Schnabel & Wagner, 2007, p. 12). There appears to be a set of social conditions that restrict women from joining trade unions, such as the social position associated with women’s work, the restrictions deriving from family responsibilities, and even the workings of trade union structures (European Trade Union Confederation, 2002). Despite this, between 2003 and 2008 there was an increasing proportion of female trade union members in most European countries. This “suggests that their membership is tending to hold up better than men’s in union organisations that are decreasing in size, and that they are making up a greater proportion of growth in organisations that are expanding” (Carley, 2009, p. 19). In 2014, 65% of all union members in Malta were men and only 35% were women (Government of Malta, 2015, November 6), reflecting the fact that around 63% of all workers are men (National Statistics Office of Malta, 2015). Thus, it comes as no surprise that Malta’s General Workers’ Union is among the most male-dominated main trade unions in Europe (Carley, 2009). However, in line with the trend in other EU countries (Carley, 2009), the ratio of female trade union membership in Malta is on the increase. Besides, in line with several other EU countries, women in Malta tend to be particularly numerous in unions that represent professionals and other white-collar workers. It is thus hypothesised that, despite the difference between raw male and female membership figures in Malta, working women are as likely to be unionised as much as working men.

3.2 Age

Issues relating to the unionisation of young persons have also been well documented (e.g. Blanchflower, 2007; Checchi et al., 2010; Eurofound, 2010; Bernaciak et al., 2014). Eurofound (2010) lists young age as one of the four main contributors to low trade union density, stating that young workers “seem to be almost invariably the most problematic group of workers to unionise” (p. 13). Indeed, in most European countries, trade union density of younger persons is well below average, whereas in a number of countries, half the current trade union members are set to retire within a decade (Bernaciak et al., 2014). Trade unions across Europe appear to be aware of this time-bomb and established specific structures for young workers. Eurofound (2010) and Bernaciak et al. (2014) describe various strategies being adopted by trade unions to recruit and organise young persons, with varying levels of success. In a study carried out on data across 38 countries, Blanchflower (2007) found an inverted U-shaped pattern of unionisation in relation to age – peaking in the mid to late 40s across most of the examined countries. He attributes this phenomenon in part to cohort effects. Similarly, analysing data from seven European countries, Checchi et al. (2010) found that union membership peaks between the ages of 47 and 61. However, Schnabel and Wagner’s 2007 findings do not support the U-shaped pattern of unionisation. The authors argue that this might have occurred due to the large number of control variables they used. While there exists no documentation on the topic of age and unionisation in Malta, there is a shared perception that young persons are less interested in unions than older ones. However, is such a lower interest related to the type of job or economic sector that young persons are joining, or does it exist irrespective of such circumstances? Many of the jobs occupied by youths in Malta are in sectors which are difficult for the unions to organise such as wholesale and retail, and the emerging ICT and finance fields. In line with most foreign research, it is hypothesised that young employees are less likely to join trade unions when compared to older ones.

3.3 Education and Occupation

According to Checchi et al. (2010), in general, lower qualified workers have a higher probability of union membership than tertiary qualified ones. However, as argued by Schnabel (2013), empirical evidence for this relationship is flimsy. Indeed, other variables appear to intervene in such relationship. For instance, Blanchflower (2007) found that, in the UK, while overall schooling and qualifications are positively related to membership in the public sector, they are negatively related to membership in the private sector. While within the public sector, a person with a first degree is more likely to be

unionised than someone without a first degree, the opposite is true in the private sector. Checchi et al. (2010, p. 95) themselves found that “among women, university graduates do not have a lower likelihood of membership than women with lower levels of schooling”. Indeed, in line with Blanchflower (2007), the authors tentatively link this to the “larger proportion of highly educated women employed in unionised public service professions like teaching and nursing” (Checchi et al., 2010, p. 95). When compared to highly qualified persons, lower qualified ones are more likely to be or become blue-collar workers. The latter are easier to organise in trade unions than white-collar workers, since they have more homogeneous preferences and experience more homogeneous working conditions (Schnabel & Wagner, 2007). Descriptive evidence in Schnabel and Wagner (2007) indicates that trade union density is higher for blue-collar than white-collar workers in half of 18 countries investigated and while it is lower in the other half.

As noted earlier, trade unionism in Malta was traditionally mainly fuelled by less qualified blue-collar workers; the GWU is mostly focused on such a section of the working population. While the unions representing white collar workers are increasing in size, they are still much smaller than the GWU (Debono, in press). Thus, despite the lack of clarity in European research, it is hypothesised that lower qualified employees and employees in blue-collar jobs in Malta are more likely to be unionised than higher qualified employees and employees in white-collar jobs.

Trade unions have also been traditionally associated with workers holding typical working contracts. However, in many countries including Malta, the share of full-time workers is decreasing while that of atypical workers such as part-timers and persons in definite contracts is increasing. “Atypically employed workers usually have weaker ties to their current workplace and are more difficult to recruit and keep as union members” (Schnabel, 2013, p. 260). While most research appears to support the claim that full-time workers have higher trade union density rates than those working on a part-time basis (e.g. Visser, 2006; Blanchflower, 2007), some studies do not (e.g. Schnabel & Wagner, 2007). Interestingly, Visser (2006, p. 47) found that “the gap in unionisation between part-time and full-time employees is narrowing in some countries in Northern Europe – most strongly in those wherein a part-time job is both widely diffused and ‘normalised’”. While in Malta atypical workers tend to enjoy the same legal protection as typical workers, atypical contracts are not yet as widely diffused and do not seem to be ‘normalised’. Thus, it is hypothesised that employees holding full-time and indefinite contracts are more likely to be unionised than those in part-time jobs and with definite contracts.

3.4 Employment Sector and Economic Activity

Strong evidence links unionisation and employment in the public sector across European countries (Checchi et al., 2010; Eurofound, 2010; Schnabel, 2013). In the public sector, it is easier to organise employees in unions due to “lower recruitment costs in large homogeneous organisations with low turnover rates and low employer hostility towards unionism” (Schnabel, 2013, p. 259). In line with such research, union representation in Malta’s public sector is much stronger than in the private sector. It is therefore hypothesised that Malta’s public employment sector has much higher levels of unionisation than the private sector.

Unionisation in Malta has also been traditionally strong in the secondary sector and weak in the primary and tertiary sectors. This phenomenon might be due to the small size and family-ownership of the traditional organisations in last two sectors (Debono, 2004), and to the unitarist strategic human resource management stance often adopted in the emerging tertiary subsectors (Debono, in press). However, Malta, like other European countries, is experiencing a decline in the manufacturing sector and an expansion of the services sector, some of which is difficult for the unions to organise. Nevertheless, this expansion has been reflected in the smaller occupational and in-house unions often catering for white-collar workers in the tertiary sector gaining ground in membership levels in relation to the two large general unions. Whereas in 2004, these small unions represented 16% of all union membership, in 2014 they represented 19.8% (Government of Malta, 2004, December 30, 2015, November 6). This trend appears to follow developments in Europe. Indeed, Visser (2012) discussed how the decline of industry, together with changes in organising and sectoral bargaining, have led to a decline in industrial unionism across different countries. He argued that “the expansion of the public sector and the unionisation of teachers, nurses, and many other service providers in the welfare state have led to even the mainstream and left-leaning trade union federations becoming, for the most part, white-collar organisations” (Visser, 2012, p. 135). On the other hand, Schnabel (2013) indicated that the empirical evidence for the impact of sectoral changes on union density is not clear and may vary from one country to another. It is hypothesised that, despite the decline in Malta’s manufacturing industry, employees in the secondary sector are still more likely to be unionised than those in the tertiary sector, as reflected by the fact that the GWU is still by far the largest union in Malta.

In support of the above often unclear international literature, in their research carried out on data from 18 different European countries, Schnabel and Wagner (2007, p. 24) found that “the same covariates have

a rather different explanatory power across countries". Such findings reinforce the idea that it is important to investigate potential determinants of trade unionism in relation to specific countries due to the latter's idiosyncratic characteristics. Malta's distinct development of its industrial relations system, together with its particular socio-economic circumstances, may affect the nature of union membership in particular ways.

The next section outlines the methodology used for this study.

4 Methodology

This study adopts a quantitative methodology to investigate the relation between a set of socio-demographic variables and trade union membership levels in Malta. A brief survey was developed and pilot tested as part of a larger project aimed at shedding more light on trade unionism in Malta. The project was carried out by the author under the auspices of the Centre for Labour Studies of the University of Malta and the President's Foundation for the Wellbeing of Society in 2014/2015.

Data gathering was carried out by Malta's National Statistics Office (NSO) through Computer Assisted Telephone Interviewing (CATI). A representative sample of the adult population of Malta aged between 16 and 64 years and residing in discrete dwellings was chosen via stratified random sampling based on the variables of sex, age group and locality. This methodology ensured a good spread of the sample relative to the population.

Out of 2,008 sampled persons who were eligible to participate in the study, 1,512 good responses were derived, resulting in an effective response rate of 75.3%. Out of these responses, the sub-sample of 781 employees was used for the current study.

Quality control during data collection was implemented via a series of measures consisting of quality checks and in-built validation rules in the data collection program to limit the occurrence of non-sampling errors. Missing values were imputed using a hot deck methodology, by considering donors according to district, age group and sex of respondents. The mode of the respective category was taken as the imputed value. Numerous measures were taken to ensure that non-sampling errors were kept to a minimum. Experienced interviewers

were used throughout the data collection process and appropriate supervision was conducted throughout. Interviewers were provided with precise definitions of the terms used in the survey to avoid varied interpretations.

The following section presents the results of this study, first by highlighting some important descriptive data and subsequently by analysing the relationships of interest in this study through inferential statistics.

5 Results

As can be seen from Table 1, just over a third of respondents (33.8%) are trade union members. Slightly less than half of the respondents (47.8%) have never joined a trade union, while another 18.4% used to be trade union members. There is no significant gender difference in the trade union membership status: $\chi^2(2, N = 781) = 0.393, p > 0.05$, Cramer's $V = 0.022$.

As can be seen in Table 2 below, older employees are significantly more likely to be members of trade unions when compared to younger ones: $\chi^2(2, N = 781) = 7.864, p < 0.05$, Cramer's $V = 0.100$. While only 23.5% of the youngest employees (aged 15–24) are members of trade unions, the figure increases to 38.6% among the oldest employees (aged 45–64). When examining these results by gender, it becomes apparent that age bracket is strongly related to trade union membership among male employees: $\chi^2(2, N = 469) = 15.760, p < 0.001$, Cramer's $V = 0.183$, but not among female employees: $\chi^2(2, N = 312) = 0.051, p > 0.05$, Cramer's $V = 0.013$.

The membership of employees in trade unions increases significantly with their educational level $\chi^2(2, N = 781) = 21.767, p < 0.001$, Cramer's $V = 0.167$. Thus, whereas only 26.1% of employees with no formal/primary/secondary level of education declare to be trade union members, the figure rises to 45.1% among employees with a tertiary level of education. An analysis of the results by gender indicates that the level of education is strongly related to members among female employees $\chi^2(2, N = 312) = 26.410, p < 0.001$, Cramer's $V = 0.291$, but not among male employees: $\chi^2(2, N = 469) = 2.766, p > 0.05$, Cramer's $V = 0.077$.

The respondents' occupation is significantly related to trade union membership: $\chi^2(4, N = 781) = 10.904, p < 0.05$, Cramer's $V = 0.028$ (see Table 3). Senior officials, professionals and technicians are the most likely

Table 1: Trade union membership status of employees by gender.

	Male (%)	Female (%)	Total (%)	N	P	Cramer's V
I was never a member	48.0	47.4	47.8	781	0.393	0.022
I was a member in the past	19.0	17.6	18.4			
I am a member	33.0	34.9	33.8			

$N =$ Number of participants; $P =$ Pearson Chi-Square

Table 2: Trade union membership by age, education and gender

			Yes (%)	No (%)	<i>N</i>	<i>P</i>	Cramer's <i>V</i>
Age bracket of employees	Male	15-24	12.7	87.3	469	15.760***	0.183
		25-44	33.6	66.4			
		45-64	40.7	59.3			
	Female	15-24	35.7	64.3	312	0.051	0.013
		25-44	35.1	64.9			
		45-64	33.8	66.2			
	Total	15-24	23.5	76.5	781	7.864*	0.100
		25-44	34.2	65.8			
		45-64	38.6	61.4			
Level of education of employees	Male	None/Primary/Secondary	29.7	70.3	469	2.766	0.077
		Post-secondary	34.4	65.6			
		Tertiary	38.7	61.3			
	Female	None/Primary/Secondary	19.0	81.0	312	26.410***	0.291
		Post-secondary	36.9	63.1			
		Tertiary	51.4	48.6			
	Total	None/Primary/Secondary	26.1	73.9	781	21.767***	0.167
		Post-secondary	35.3	64.7			
		Tertiary	45.1	54.9			

N = Number of participants; *P* = Pearson Chi-Square; *** = < 0.001; * = < 0.05

occupational categories to be unionised, while clerical workers are the least likely. However, the difference is not particularly high, and becomes statistically insignificant when one examines trade union membership by occupation and gender.

Table 3 indicates that employees on indefinite contracts are significantly more likely to be trade union members than those on definite contracts (35.8% and 24.4% respectively): $\chi^2(1, N = 781) = 6.388, p < 0.05$, Cramer's *V* = 0.090. When examining type of contract and trade union membership by gender, it become apparent that, while there are no strong differences among males: $\chi^2(1, N = 469) = 0.812, p > 0.05$, Cramer's *V* = 0.042, females are significantly more likely to be trade union members if they work on indefinite rather than definite contracts: $\chi^2(1, N = 312) = 7.711, p < 0.01$, Cramer's *V* = 0.157.

Employees on full-time contracts are also significantly more likely to be trade union members than those on part-time contracts (38.0% and 9.5% respectively): $\chi^2(1, N = 781) = 36.010, p < 0.001$, Cramer's *V* = 0.215. This result holds among both male and female employees (see Table 3).

As can be seen in Table 4, respondents employed in the public sector are significantly more likely to be trade union members than those employed in the private sector (55% and 22% respectively): $\chi^2(1, N = 781) = 87.647, p < 0.001$, Cramer's *V* = 0.335. The difference is significant among both male and female employees.

As it may be expected, the larger the number of employees at the company/organisation that the respondents work in, the more likely it is that they are trade

union members: $\chi^2(1, N = 475) = 37.334, p < 0.001$, Cramer's *V* = 0.280. Indeed, while only 8.9% of employees in companies with less than 50 employees are members of trade unions, the figure grows to 32.6% among respondents who work in organisations employing 50 or more employees. The difference is similarly significant among both male and female employees.

Trade union membership is also significantly related to type of economic activity: $\chi^2(7, N = 779) = 91.217, p < 0.001$, Cramer's *V* = 0.357. The most densely unionised economic activities are education (57.7% of the respondents in this sector claim to be unionised), and human health and social work activities (54.3%) (see Table 5).

6 Discussion

This section first discusses the general trade union membership figures in Malta and subsequently focuses on the relationship between socio-demographic characteristics and trade union membership.

6.1 General Membership Figures

While it was known that official trade union membership numbers in Malta might be inflated (e.g. Baldacchino, 2007, May 20), the result emerging from this survey is remarkable and thought provoking. Just over a third of employees in Malta stated to be trade union members, a figure which is drastically lower than the typically quoted range of trade union membership levels in Malta, which hovers around the 53-59% as mentioned in the literature review. The alternative methodology used in this study still indicates that Malta's trade union

Table 3: Trade union membership by occupation, type of contract and gender.

			Yes (%)	No (%)	<i>N</i>	<i>P</i>	Cramer's <i>V</i>
Occupation	Male	Senior officials, professionals, technicians	38.5	61.5	469	7.805	0.099
		Clerical workers	27.9	72.1			
		Service workers	22.2	77.8			
		Skilled & craft workers	37.0	63.0			
		Operators, assemblers & elementary occupations	29.8	70.2			
	Female	Senior officials, professionals, technicians	42.3	57.7	312	7.652	0.105
		Clerical workers	27.3	72.7			
		Service workers	35.5	64.5			
		Skilled & craft workers ^a	16.7	83.3			
		Operators, assemblers & elementary occupations ^a	23.5	76.5			
Total	Senior officials, professionals, technicians	40.1	59.9	781	10.904*	0.028	
	Clerical workers	27.5	72.5				
	Service workers	29.1	70.9				
	Skilled & craft workers	35.4	64.6				
	Operators, assemblers & elementary occupations	28.1	71.9				
Definite/Indefinite contract	Male	Definite contract	28.1	71.9	469	0.812	0.042
		Indefinite contract	33.8	66.2			
	Female	Definite contract	21.1	78.9	312	7.711**	0.157
		Indefinite contract	39.0	61.0			
	Total	Definite contract	24.4	75.6	781	6.388*	0.090
Indefinite contract		35.8	64.2				
Full-time/Part-time contract	Male	Full-time contract	34.9	65.1	469	9.723**	0.144
		Part-time contract	8.8	91.2			
	Female	Full-time contract	43.9	56.1	213	31.026***	0.315
		Part-time contract	9.8	90.2			
	Total	Full-time contract	38.0	62.0	781	36.010***	0.215
Part-time contract		9.5	90.5				

N = Number of participants; *P* = Pearson Chi-Square; *** = < .001; ** = < .01; * = < .05

^a Treat with caution due to small sample size

density is higher than the EU average of about 23% (European Trade Union Institute, 2014), but is closer to the Anglophone and Southern European groups of countries rather than the Nordic one. One should note that the methodology used in this study is prone to bias deriving from the fact that it relies on respondents' declarations rather than real facts. Besides, unlike official statistics, this survey does not capture the situation in which employees might be members of more than one

union. However, considering the limitations relating to the traditional way of measuring Malta's trade union density (discussed earlier) and the country's historic-political and socio-cultural similarities to the British and Southern groups, the current figure offers a potentially more credible alternative representation of the local situation. The findings of this research are also in line with Baldacchino and Gatt (2009) who traced the proportional decline (in relation to the growth of the sector) of

Table 4: Trade union membership by sector, organisational size and gender.

			Yes (%)	No (%)	<i>N</i>	<i>P</i>	Cramer's <i>V</i>		
Sector	Male	Public sector	51.2	48.8	469	37.630***	0.283		
		Private sector	23.3	76.7					
	Female	Public sector	60.3	39.7	312				
		Private sector	19.9	80.1					
	Total	Public sector	55.0	45.0	781				
		Private sector	22.0	78.0					
Organisation size (private sector only)	Male	Less than 50 emp.	8.3	91.7	297	31.293***	0.325		
		50 or more emp.	36.0	64.0					
	Female	Less than 50 emp.	10.1	89.9	178			7.750**	0.209
		50 or more emp.	27.5	72.5					
	Total	Less than 50 emp.	8.9	91.1	475				
		50 or more emp.	32.6	67.4					

N = Number of participants; *P* = Pearson Chi-Square; *** = < 0.001; ** = < 0.01

Table 5: Trade union membership by economic activity.

	Yes (%)	No (%)	<i>N</i>	<i>P</i>	Cramer's <i>V</i>
Manufacturing	31.8	68.2	779	91.217***	0.357
Education	57.7	42.3			
Public administration	30.5	69.5			
Health & social work activities	54.3	45.7			
Wholesale, retail, repair of vehicles, accommodation, food service	10.1	89.9			
Information, communication, transportation, storage	34.7	65.3			
Professional, scientific, technical, administrative & support service	7.3	92.7			
Other economic activities	44.6	55.4			

N = Number of participants; *P* = Pearson Chi-Square; *** = < 0.001

trade unions in private sector companies between 1995 and 2008.

The retention of trade union members is another important aspect of unionisation which deserves greater scrutiny in Malta. Trade unions should not only aim to attract new members but also to retain them. This study indicates that nearly a fifth (18.4%) of all employees in Malta aged between 15 and 64 ceased to be trade union members at some point. While the reasons for this go beyond the scope of the current study, it appears that a substantial number of employees who were previously unionised, at some point in their careers felt that their membership was no longer worthwhile.

The above findings do not diminish the significant social contributions of trade unions in Malta, ranging from the macro policy-related ones to the micro ones at workplace level. A not-so-high trade union membership does not necessarily equate to low social impact. As demon-

strated by a case study in France, a trade union movement may exert a strong influence on government policy (da Conceição-Heldt, 2008) even with much lower union density than that of Malta.

6.2 Socio-Demographic Characteristics and Membership

While European and international literature demonstrates the hegemonic masculinity of the trade union movement (e.g. Ledwith, 2012; Rea, 2005), a phenomenon also reflected in the male dominance of Maltese unions, gender was not found to be a significant predictor of trade union membership in Malta. Using Schnabel and Wagner's 2007 reasoning, the similar likelihood of both genders joining trade unions might indicate the women's growing attachment to the labour force, which increases their benefit of unionisation. Women in Malta are investing more in their career, as demonstrated by their growing employment rate. Con-

sidering the many gender-related obstacles at work (National Commission for the Promotion of Equality, 2012), it stands to reason that working women are seeking unionisation as much as men. This finding should not be confused with the fact that, in line with the general situation across the European Union (Carley, 2009), women represent a minority in the overall number of unionised employees in Malta; 41.3% of all trade union members are females according to the current survey, when compared to a slightly lower figure of 35% found in the official statistics. This finding reflects the gender ratio of employees in Malta. If through the continued support of government policy and the increasing qualifications of women, female employment continues to grow at a faster rate than that of males, the gap in absolute membership numbers is expected to close down significantly in the coming years.

The trade union movement in Malta, as in other European countries (Jensen, 2006), has traditionally developed and flourished among the skilled manual working-class population. However, this research has shown a diverging reality in which employees with post-secondary or tertiary qualifications are currently more likely to be unionised than those who hold lower qualifications. This finding appears to contradict the general trend witnessed in Europe in which the higher qualified workers care less about collective identities and interests and adopt more individualised employment relations (Eurofound, 2010). Indeed, the higher qualified workers in Malta might better appreciate the workplace role of trade unions than lower qualified ones. A deeper examination of this finding reveals that the positive relationship between qualifications and trade union membership is much stronger (and only statistically significant) among female workers. The lower qualified women are particularly detached from trade unions, while the highly qualified ones are more unionised than their male counterparts. This finding might be explained, at least in part, by the fact that a substantial percentage of highly qualified women work in education and healthcare, the two most highly unionised sectors in Malta. Previous research indicated that a union presence at the place of work significantly improves attitudes towards trade unions (Turner & D'Art, 2012). This finding linking higher educational qualifications to trade union membership is also reflected in a slightly increased unionisation rate of senior officials, professionals and technicians when compared to other occupations. However, the relation is not very strong and becomes statistically insignificant when one examines genders separately. Perhaps such a relation is weaker than expected given that a substantial number of workers are in occupations that do not reflect their qualifications. For instance, many tertiary educated persons in Malta hold clerical

occupations.

In line with foreign research (e.g. Eurofound, 2010), age positively predicts union membership, even in Malta. The finding might be explained through young workers' attitudes towards unionisation which, according to Turner and D'Art (2012), ranges from indifferent to hostile. When compared to their older peers, younger employees may be less willing, or aware of the possibility of defending their rights through unions. Research carried out among students in Australia showed that they tend not to understand the union's role in overcoming the power imbalance between employer and employee through solidarity or collective strength (Bulbeck, 2008). Young workers might retain such attitudes at least for the first years of their employment. Due to its cross-sectional nature, the current study does not indicate whether the younger cohorts will reach the same unionisation levels as the older cohorts over a number of years. However, considering the general lowering of trade union densities and the fact that many young persons are finding employment in the less unionised services sector, this appears to be unlikely, unless trade unions make a major effort to reverse the trend.

Foreign research indicates that workers in atypical work relationships are difficult to unionise (Schnabel, 2013; Eurofound, 2010). Thus, it is not surprising that part-time employees in Malta are much less likely to be unionised than full-time employees. Different tentative explanations from the perspectives of unions and employees can shed light on the part-timers' distance from trade unions. On the one hand, in line with their traditional roots, trade unions appear to be still geared towards the protection of employees in typical full-time jobs. On the other hand, part-timers might view trade union membership less favourably as they might be more likely to perceive their job as a transient income-generating activity rather than a 'career' which requires long-term protection. They may be more prone to fear reprisals by employers if they join unions. Besides, the burden of membership costs might be higher for part-timers.

As expected, employees on definite contracts are less unionised than those on indefinite contracts. However, such difference is only statistically significant among women, and is not as strong as the difference in unionisation between full-time and part-time employees. Part-time work, which characterises about 15.1% of all employees in Malta, is more diffused and possibly more normalised, than fixed-term contracts that can be found among 7.5% of all employees (National Statistics Office of Malta, 2014). Thus, adopting Visser's 2006 logic, one would have expected a greater unionisation rate of part-timers than those on definite contract. However, this is not so. Such unexpected finding might be partially ex-

plained by the fact that part-timers spend less time at the place of work than persons on a fixed-term contract (most of whom are full-time employees) and so have less time to interact with union representatives. Besides, for many persons in Malta, a fixed-term contract might be the first step towards indefinite employment with the same employer – this expectation might motivate many employees on definite contracts to join a union. On the other hand, aspects such as fear of reprisals by employers might deter the unionisation of some individuals on definite contracts.

In line with other countries across the EU (Eurofound, 2010), employees in the private sector are significantly less likely to be unionised when compared to their peers in the public sector. Indeed, the education and health and social work activities sectors, which predominantly lie in the public sector, are the most unionised. The relatively lower membership levels in the private sector, especially in the services industry, may be attributed to unfavourable conditions such as low union presence (including lack of shop stewards), negative employers' attitudes against unions, and the dynamics prevailing in small family-owned organisations. To-date, trade unions in Malta have not established a strong presence in emerging services sectors such as financial services, the online gaming industry, and call centres.

7 Conclusion

The discrepancy in trade union density figures deriving from this survey and official administrative data (namely a third versus more than a half of employees being unionised), indicates that research based on official data might be offering a substantially inflated picture of unionisation in Malta. The difference is too large to be solely attributable to possible errors in the survey results, and it is more likely that the official density figures traditionally used in Malta are misleading. This is problematic on a number of levels. At a rather academic level, it might mean that the way Malta is classified for statistical purposes is not correct, and that local, European or international statistics that include Malta are inaccurate. From an administrative point of view, the government is expected to ensure that unions provide a true and fair view of not only their finances but also their membership. EIRA (Government of Malta, 2002) provides the government with the authority to inspect such records. Any lack of or insufficient action on this matter goes against the spirit of the law. On the other hand, if one takes the trade unions' perspective, one could be tempted to sympathise with those unions who might in one way or another inflate their membership figures for the greater good of their cause, since unions traditionally often get their strength in numbers. However, wouldn't it also be in their long term interest

to provide more realistic membership figures? After all, facing and accepting what might be a gloomier reality than what appears on paper, might provide the motivation and ingenuity required for unions to reorganise themselves and improve their operations in order to attract and retain more members.

The examination of membership according to socio-demographic variables provides some general directions that should be taken into consideration in any eventual trade union renewal. The picture emerging from the current findings is largely in line with EU trends, while also reflecting Malta's distinctive characteristics. As expected, several socio-demographic characteristics – such as older age, full-time and indefinite contracts, and employment in the public sector – are positively related to trade union membership. On the other hand, some results diverge from mainstream literature, in particular the similar membership levels of male and female workers, and the higher unionisation of the more qualified persons, especially women.

The latter findings reflect the specific policy and socio-economic developments taking place in Malta since the country joined the EU in 2004. When Malta's statistics started to be compared to those of the EU, it became apparent that the country had particularly low levels of women in employment and tertiary educated workers. Government policy was soon directed to improve the situation and massive EU funds were funnelled towards various measures which brought about substantial improvements on both fronts over a period of less than 15 years. Many more persons, especially women, started acquiring tertiary level qualifications and joining the labour market. The female participation rate grew by twenty percentage points in two decades. Unions focusing on graduates experienced strong increases in members, especially women. Considering the substantial union membership density of women, it does not make much sense that men still occupy nearly all the top positions in unions in Malta. A greater female representation at the higher union levels would bring about new perspectives and potentially better assist the growing number of female trade union members, and ensure that women members are retained.

This study portrays a rather traditionally-oriented trade union movement in Malta, which appears not to be particularly effective in attracting and retaining younger workers, part-time workers, workers on definite contracts and those in the private sector, especially in smaller organisations. The traditional cadre of union members is set to continue declining in the coming years due to economic, organisational and demographic trends. Thus, unless unions in Malta reorganise themselves and refocus their strategies, trade union density and membership are likely to drop.

This study, the first of its kind in Malta, provides a noteworthy alternative to existing official union density figures, and offers a more detailed picture of trade union membership than was previously available. However, the cross-sectional nature of the study, taking a snapshot at one point in time, carries the limitations of being unable to establish causality and shed light on long term trends. Thus, it is suggested that future research on this topic adopts a longitudinal design, which would not only clarify trends but also enhance causal inference.

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Bridging the Gap Between Yoga and Science: A Mini Review

Shimul Sujit Sen¹ and Gabriele Deidda*¹

¹Laboratory of Neurophysiology, Department of Physiology and Biochemistry, University of Malta, Msida, Malta

Abstract. Yoga is an ancient tradition arising from the evolving cultures of ancient India originating from a variety of sources like primeval texts, oral transmissions through lineages, iconography and songs. It has a complex history of spiritual exploration, philosophical reflection and creative expression. Yoga has evolved over time to suit the needs of the current population. At present, humanity at large views things, especially the mystical arts, through the lens of the sceptical scientist. Despite countless benefits of yoga and meditation to the overall health and mind of a person that have been documented over time, they have mostly been seen as informal and only a few studies using a rigorous scientific methods have been performed. Most recently, through the advent of cutting-edge scientific tools (i.e., electroencephalogram, EEG), the gap between the subjective and objective has been bridged. Nevertheless, the path to scientific inquiry supporting yoga is a work in progress. In this minireview, we will make a short historical resume of the scientific studies carried out to investigate the effect of yoga in the physiology of the body and the brain, and its possible use to ameliorate pathological conditions.

Keywords: Yoga, EEG, anxiety, epilepsy

1 Introduction

The role of yoga has evolved over the centuries with several different sources such as the *Vedas* meaning sacred knowledge (1700–1100 BCE), the *Upanishads* which include contemplative practices for finding oneness (first millennium BCE), the *Bhagavad Gita* or the song of god, the *Yoga Sutras* of Patanjali or the aphorisms (around 200 CE) where Patanjali begins with a simple question of “what is yoga?” leading to a simple answer centred around steadying the mind (Stephens, 2010). The path to modern yoga from these sources was not straightfor-

ward. *Tantra Yoga* has a major part to play as it offers an integrative approach to yoga, that every and any experience is divine, thus, establishing the bedrock of the modern yoga body-oriented practices of yoga under the all-inclusive tantra ideology. Finally, we have *Hatha Yoga* from the sources of the *Hatha Pradipika*, *Gheranda Samhita* and *Shiva Samhita* which form the roots of the ever-expanding modern hatha yoga traditions of *Vinyasa*, *Iyengar*, *Anusara*, *Ashtanga Vinyasa* and others that are variations on a tradition with a branded name (Stephens, 2010). There are three main aspects of yoga which seem to be universally agreed upon despite their various forms and styles: *i*) *Asana*, the physical seat or series of movements, *ii*) *Pranayama*, the sequences of breath refinements, and *iii*) *Dhyana*, the meditation or contemplation.

Yoga has been always associated with providing general benefits to the body and mind. Nevertheless, reports had always been informal and only recently thanks to the development of new scientific tools have the benefits of yoga been investigated with a proper scientific method.

2 Effect of Yoga in the Physiology of the Body

The remarkable effect of yoga has to be reported in the general physiology of the body. In 1970, Wallace and co-workers investigated the physiological effects of transcendental meditation (Wallace, 1970), a technique defined as “turning the attention inwards towards the subtler levels of a thought until the mind transcends the experience of the subtlest state of the thought and arrives at the source of the thought” (Yogi, 1969). The study reported a decrease in oxygen consumption and heart rate as well as an increase in skin resistance during meditation. In another study, Kamei and co-workers found a decrease in blood levels of serum cortisol during yoga exercise (Kamei et al., 2000). Gathered together

*Correspondence to: Gabriele Deidda (gabriele.deidda@um.edu.mt)

these findings provide a scientific basis to support the anti-stress benefits of yoga and meditation practices.

3 Effect of Yoga in the Physiology of the Brain

Apart from the effects on the general physiology, important effects of yoga have been reported in the brain (Table 1), for example in modulating the level of some neurotransmitters. By means of modern imaging techniques, an increased endogenous dopamine release in the ventral striatum during *Yoga Nidra* meditation has been reported (Kjaer et al., 2002). Nevertheless, the most remarkable and interesting effect of yoga has been reported on the activity of the brain, and most of the scientific studies aimed to investigate it used electroencephalogram (EEG), a non-invasive technique that allows the recordings of the overall activity of the brain by means of electrodes attached to the scalp.

Vialatte and co-workers employed high-density array EEG system (128 electrodes) to record the brain activity in subjects performing a specific form of yoga breathing technique called *Bhramari Pranayama*. They found that low-frequency power was diminished with the increase of the high-frequency gamma waves (Vialatte, Bakardjian, Prasad & Cichocki, 2009) which is usually a characteristic of a high state of arousal even if recorded in a state of relaxation (breathing). A follow-up study showed that the increase in gamma power activity is something common to a variety of meditation practices such as *Vipassana*, *Himalayan Yoga* and *Isha Shoonya*, and was positively correlated with the meditation experience (Braboszcz, Cahn, Levy, Fernandez & Delorme, 2017). High-band power in alpha and theta spectra has also been reported in *Rajyoga* meditators (Sharma, Chandra & Dubey, 2018). Interestingly, in this latter study researchers found an overall higher power spectrum in parietal and frontal areas (Sharma et al., 2018), demonstrating the ability of meditators to specifically increase brain activity in specific areas of the brain.

Altogether, these studies showed that yoga practice does have an effect on the activity of the brain by increasing the power of high-frequency bands in the EEG resulting in a more desynchronized pattern.

4 Yoga and Epilepsy

Given the remarkable effect of yoga in desynchronizing the EEG, researchers have tried to apply yoga to get seizure-control in patients affected by epilepsy, a neurological disorder characterized by recurrent paroxysmal alterations in behaviour associated with synchronous and abnormal discharges of large neuronal populations. Overall, 0.5–2.0% of the world's population is affected by epilepsy (Fisher, 2017). In a study of Panjwani and co-workers, researchers selected patients with idiopathic

Table 1: Summary of the effects of Yoga in the physiology and the pathology of the brain.

Effect in the brain	Reference
Yoga Nidra meditation increased endogenous dopamine release in the ventral striatum	Kjaer et al. (2002)
Yoga Bhramari Pranayama diminished the low-frequency power and increased the high-frequency gamma waves	Vialatte, Bakardjian, Prasad and Cichocki (2009)
Vipassana, Himalayan Yoga and Isha Shoonya increased gamma power activity	Braboszcz, Cahn, Levy, Fernandez and Delorme (2017)
Rajyoga increased the power of alpha and theta waves	Sharma, Chandra and Dubey (2018)
Sahaja yoga meditation decreased seizure frequency and shift the frequency EEG from lower to higher bands in patients with idiopathic epilepsy	Panjwani et al. (1996)
Yoga decreased anxiety	Hardt and Kamiya (1978), Field, Diego and Hernandez-Reif (2010)
Rhythmic breathing helped to control the tobacco habit	Kochupillai et al. (2005)
Yoga reduced the risk of alcohol and drug abuse consumption in veteran and civilian women with posttraumatic stress disorder	Reddy, Dick, Gerber and Mitchell (2014)

epilepsy and assessed the effect of Sahaja yoga meditation on seizure control and EEG alterations.

Patients practicing yoga reported an 86% decrease in seizure frequency. Moreover, EEG recordings showed a shift in frequency from lower (0–8 Hz) to higher (8–20 Hz) bands (Panjwani et al., 1996). Then, yoga practice could support seizure control providing a way to ameliorate the quality of life in those affected by epilepsy.

5 Yoga and Anxiety

Since yoga is a practice known to induce relaxation, researchers had studied its effect on anxiety. Among the EEG rhythms, alpha waves (8–15 Hz) are mostly involved in anxiety because they are present during relaxed wakefulness and thereby generally associated with a relaxed state of mind. An earlier study showed that when individuals with high anxiety traits were able to increase their alpha wave activity, they showed less anxiety-associated symptoms (Hardt & Kamiya, 1978). Field and co-workers reported a decreased (self-reported) anxiety in participants practicing yoga (combined with tai-chi). Moreover, a trend for increased EEG theta activity (non-significant) was also reported (Field, Diego & Hernandez-Reif, 2010).

6 Yoga in the Treatment of Addiction of Drugs of Abuse

Given the pivotal positive effects of yoga in the general wellbeing of the individual, it does not come as a surprise that yoga has been proposed to be used in the treatment of addiction of drug of abuse, in particular in ameliorating the withdrawal symptoms. For example, in a group of cancer patients rhythmic breathing (Sudarshan Kriya and Pranayam) helped to control the tobacco use in 21% of individuals (Kochupillai et al., 2005). Also, individuals with posttraumatic stress disorder are more likely to experience high-risk substance behaviours associated to drug abuse and, thus, complementary therapies are needed. A pilot randomized controlled trial reported that a yoga therapy intervention reduce the risk of alcohol and drug abuse consumption in veteran and civilian women with posttraumatic stress disorder (Reddy, Dick, Gerber & Mitchell, 2014).

7 Conclusion

In conclusion, despite the informal positive effects of yoga and meditation on body and mind reported over the centuries, only recently have we pushed away the scepticism and developed the scientific tools to start investigating it through thorough factual experiments that led to positive results and, thus, setting a solid foundation for further experimentation as science progresses. These studies do demonstrate that yoga does influence the physiology of the body and the brain. More importantly, the ongoing investigation of yoga needs to take a forefront if we are to successfully increase the overall quality of life, and alleviate pathological conditions.

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Commentary

Cannabis Medicine Offers Hope for Severe Paediatric Epilepsies

Giuseppe Di Giovanni*¹

¹*Neurophysiology Laboratory, Department of Physiology and Biochemistry, University of Malta, Msida, Malta*

Science does not need to take a position on legalizing the recreational use of cannabis, this is more a political issue or a personal choice. Cannabis, as the other drugs of abuse, produces several detrimental effects on brain function but differently from alcohol, nicotine, cocaine, heroin and ecstasy (just to cite the most commune abused ones) these are mostly present with acute intoxication and disappear after termination of drug intake.

Consequently, there is no scientific reason for which we have some legal drugs of abuse such as alcohol and tobacco sold by governments and others labelled as illegal and banned by society. This is, of course, a flawed situation but one that illustrates a major paradox in international laws on drugs. Despite being illegal, cannabis is (ab)used by about 87.6 million European adults (23.7% of adults) (EMCDDA, 2017). Cannabis is also the most commonly used illicit drug among the Maltese adult population aged 18–65 years. According to the 2013 general population study, around 4.3% of those aged 18–65 years reported having used cannabis during their lifetime (EMCDDA, 2017).

One of the most controversial issues in science but also in the media regards the link between marijuana and schizophrenia. It has been shown that marijuana significantly increases the risk of developing a psychotic disorder later in life, particularly among those individuals who use it at an early age, who frequently use high-potency cannabis or ‘skunk’ and who have a genetic predisposition to psychosis (Aas et al., 2018; Evins, Green, Kane & Murray, 2013). On the other hand, adult-onset cannabis use may not be associated with the same level of risk (Donoghue et al., 2014).

The link between smoking marijuana and schizophrenia is much more complicated than we thought, and as with other scientific issues, we do not have a certain response. Firstly, the aetiology of schizophrenia is very complex. In addition, not just cannabis, but also abuse of nicotine (cigarettes smoking) (Gurillo, Jauhar,

Murray & MacCabe, 2015), alcohol (Jordaan & Emsley, 2014), hallucinogens, sedatives and other substances has also been found to significantly increase the risk of developing schizophrenia (Gururajan, Manning, Klug & van den Buuse, 2012). Therefore, one potential source of overestimating this link is neglecting the effect of a poly-drug abuse when correcting the epidemiological data analyses. For example, a recent large longitudinal Danish study on 3,133,968 individuals (Nielsen, Toftdahl, Nordentoft & Hjorthoj, 2017) that took into consideration the effect of a poly-drug abuse showed a lower association compared with previous studies, with cannabis and alcohol abuse increases the risk of developing schizophrenia later in life by five and three times, respectively.

Caution should be taken when using these epidemiological data though since we really do not know if these findings indicate a causal relationship. Indeed, they might just simply indicate that those who have a predisposition to develop schizophrenia later on in life are more likely to use cannabis and indeed we know that they are more likely to suffer comorbid substance use disorders than the general population. If there is a causal role between cannabis and schizophrenia, recent results suggest that this may have been overestimated. The lack of data regarding an increase in schizophrenia incidence in countries where marijuana is legal tend to suggest this possible scenario.

Nevertheless, extreme caution has to be taken regarding the (ab)use of all drugs of addiction, including marijuana. Marijuana should definitely be forbidden to adolescents. People with a family history of schizophrenia should avoid cannabis but schizophrenia is not just caused by marijuana. Events that might have the potential to cause stress can also play a part, because genes and the environment are interconnected. Thus, people who are at risk should try to avoid substances that might damage their mental well-being. These sub-

*Correspondence to: Giuseppe Di Giovanni (giuseppe.digiovanni@um.edu.mt)

stances include marijuana or any other drug of abuse, including those that can be legally bought at any shops.

Nevertheless, I believe that marijuana and research on cannabinoids may give rise to the discovery of new potential treatments for many disorders, especially epilepsy. This idea is also shared by many neuroscientists including Dr Mechoulam (personal communication, see Fig. 1) who discovered THC in the '60s (Mechoulam & Gaoni, 1965).



Figure 1: Left, Raphael Mechoulam (Hebrew University, Israel), right, Giuseppe Di Giovanni (University of Malta, Malta) at the MNS2017 in Malta. On the background on the left, Prof. Giacomo Rizzolatti (University of Parma, Italy).

Different lines of my research in Malta are focused on the effect of cannabinoids on different types of neuropsychiatric disorders, such as drugs of addiction, anxiety and epilepsy. I do not use the chemical found in marijuana called delta-9 tetrahydrocannabinol (Δ^9 -THC), which induces marijuana's psychotropic effects, but a synthetic analogue named WIN 55,212-2, that is many times more powerful than Δ^9 -THC. As far as focal epilepsy is concerned, we have found that in temporal lobe epilepsy, synthetic cannabinoids are even more effective than the epileptic drug phenytoin. The only problem with this treatment is that the dose of cannabinoid impairs the hippocampus, an important part of the brain, and thus blocks the process that is needed for learning and memory. We have bypassed these side effects by using a new compound that blocks the breakdown of the natural cannabinoids our brain normally makes the fatty acid amide hydrolase (FAAH) inhibitor URB597. The new drug boosts the amount of self-produced marijuana in epileptics' brains. The new compound is less effective in stopping epilepsy but is longer-lasting without major side effects (Colangeli et al., 2017). We are currently following this line of intervention, trying other drugs that increase the levels of

our own cannabinoids when and where they are needed to avoid any possible side effects. This research could potentially treat millions of epilepsy patients safely.

We are also investigating status epilepticus, a life-threatening condition in which one epileptic fit follows the other without the sufferer recovering consciousness. We found that synthetic cannabinoids only had a modest effect on the development of this type of seizures. Surprisingly, when serotonin was activated, their effectiveness multiplied, stopping the fits. We have discovered an important interaction between cannabinoids and 5-HT, at the moment we are investigating various possibilities and we believe that the outcome could be important for further understanding of the pathological mechanisms and for new treatments (unpublished observations).

Finally, although cannabis has been used for a century to treat convulsive and focal epilepsy, no evidence instead exists of a role for the CB system in human absence epilepsy, a non-convulsive type of paediatric epilepsy (Crunelli & Leresche, 2002). Indeed, very few studies have investigated the involvement of the CB system in absence seizures, and their results are highly contrasting. Thanks to an RIDT grant I have started to investigate the role of the eCBs in this type of epilepsy and the results are very promising.

The governments attitude toward marijuana research is finally changing. Strikingly, only a few days ago, on June 25th 2018, the U.S. Food and Drug Administration today approved Epidiolex (cannabidiol, CBD) oral solution by GW Research Ltd. for the treatment of seizures associated with two rare and severe forms of epilepsy, Lennox-Gastaut syndrome and Dravet syndrome, in patients two years of age and older. This is the first FDA-approved drug that contains a purified drug substance derived from marijuana. It is also the first FDA approval of a drug for the treatment of patients with Dravet syndrome (see FDA News Release at <https://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm611046.htm>).

Therefore, marijuana and marijuana research should not be demonized but encouraged and supported, it may save millions of lives!

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Malta Becomes the New Hub for the Inverse Problems Community

Cristiana Sebu*¹

¹Department of Mathematics, University of Malta, Msida, Malta

Formally, an inverse problem is a mathematical framework that is used to obtain information about a physical object (cause) or theory (model) from observed measurements (effect). The solution to this problem is useful because it generally provides information about physical parameters that we cannot directly observe, and has been an important factor in the development of mathematics and science in the past 30 years. The approaches developed for inverse problems generally include numerical approximations, stability analysis, proofs of uniqueness and/or existence of the solution.

Inverse problems arise in many areas of mathematical physics and the realm of their applications is vast: medical imaging techniques, geophysical explorations, computer vision, astronomy, nondestructive testing, noninvasive evaluation, etc. Most of research is interdisciplinary and the community is constantly expanding.

More than 270 delegates coming from 36 countries and 200 universities and research institutions from across all continents attended the 9th International Conference “Inverse Problems: Modelling and Simulation” (IPMS 2018) which was organized by Prof. Cristiana Sebu (University of Malta, Malta) and was held in Malta in May 21–25, 2018, at the Paradise Bay Hotel.

The International Conference “Inverse Problems: Modelling and Simulation” (IPMS) is one of the main international forums in Applied Mathematics. Its main aims are to bring together all classical and new inverse problems areas from various international scientific schools, and to discuss new challenges of inverse problems in current interdisciplinary sciences. The conference is organized under the auspices of the leading international journals “Inverse Problems”, “Inverse Problems in Science and Engineering” and “Inverse and Ill-Posed Problems” and it has been held biennially since 2002 at the end of May. The main sponsor of the conference is The Eurasian Association on Inverse Problems (EAIP, <http://www.eurasianip.org/>). The previ-

ous IPMS Conferences were organized in Turkey in Fethiye (2002, 2004, 2006, 2008, 2014 and 2016) and in Antalya (2010 and 2012).

Prof. Cristiana Sebu from the Department of Mathematics, Faculty of Science, University of Malta, has been an active member of the International Programme Committee since 2008, and is now the Chair of the International Organizing Committee and one of the Co-Chairs of the IPMS Conferences.

The Opening Ceremony of the IPMS 2018 Conference (see Fig. 1) was moderated by Prof. Sebu. The opening speech was delivered by the Chair of the IPMS Conferences, Prof. Alemdar Hasanov Hasanoglu, and was followed by welcoming speeches by Prof. Godfrey Baldacchino, Pro-Rector for International Development & Quality Assurance of the University of Malta, and Prof. Charles Sammut, Dean of Faculty of Science of University of Malta. All speakers emphasized the fact that Malta is a safe and attractive place for organising the IPMS Conferences.

The Opening Ceremony was followed by the 2018 EAIP Awards Ceremony (see Figs. 2 and 3). The



Figure 1: The Opening Ceremony. Prof. Godfrey Baldacchino, Prof. Alemdar Hasanov Hasanoglu and Prof. Cristiana Sebu (from left to right).

*Correspondence to: Cristiana Sebu (cristiana.sebu@um.edu.mt)

2018 EAIP awards were presented to Professors Vladimir G. Romanov (Novosibirsk State University, Russia) and Otmar Scherzer (University of Vienna, Austria) for their outstanding scientific contributions to the field of inverse problems and continuous efforts to foster cooperation between researchers of Eurasian countries. The 2018 EAIP Young Scientist Awardees were Dr Giovanni S. Alberti (University of Genoa, Italy), Dr Bernadette Hahn (University of Würzburg, Germany) and Dr Andrei Shurup, (Lomonosov Moscow State University, Russia) who are all young scientists of ages below 40 with particular merits in inverse problems analysis and its applications (see Figs. 4 and 5). Jubilee plaques were then presented to outstanding experts in inverse problems on the occasion of their birthdays: Prof. Vladimir Romanov (Novosibirsk State University, Russia) for his 80th birthday, Prof. Gen Nakamura (Hokkaido University, Japan) for his 70th birthday, and Prof. Willi Freeden (Technical University Kaiserslautern, Germany) for his 70th birthday. Prof. Sebu was also awarded a plaque for her distinguished contribution to the organisation of the IPMS 2018 Conference.



Figure 2: The 2018 EAIP Award.

The meeting offered a rich program covering a whole range of numerical and theoretical developments in inverse problems and regularization techniques with applications to wave phenomena, tomography, imaging, signal processing, finance, economy, life sciences, convex analysis, Maxwell's equations, mechanics and planetary science, inverse scattering, engineering, machine learning, etc. This included five plenary lectures, 26 minisymposia organized in four parallel sessions, two poster sessions and social events.

The five special keynote lectures were as follows:

- Dr Giovanni S. Alberti (University of Genoa, Italy): Mathematical analysis of ultrafast ultrasound imaging,
- Prof. Laurent Bourgeois (Laboratoire POEMS, Paris, France): On mixed formulations of quasi-



Figure 3: The 2018 EAIP Award Ceremony: Prof. Roman Novikov, Prof. Alemdar Hasanov Hasanoglu, Prof. Anreas Neubauer, Prof. Vladimir Romanov and Prof. Ian Boman (from left to right).



Figure 4: Young Scientist Award Ceremony: Prof. Otmar Scherzer, Prof. Alemdar Hasanov Hasanoglu, Dr Giovanni S. Alberti, Dr Andrei Shurup and Prof. Roman Novikov (from left to right).

reversibility and their application to inverse obstacle problems,

- Prof. Thorsten Hohage (University of Göttingen, Germany): Stability estimates and variational source conditions,
- Prof. Thomas Schuster (University of Saarland, Germany): Different views onto solving the non-

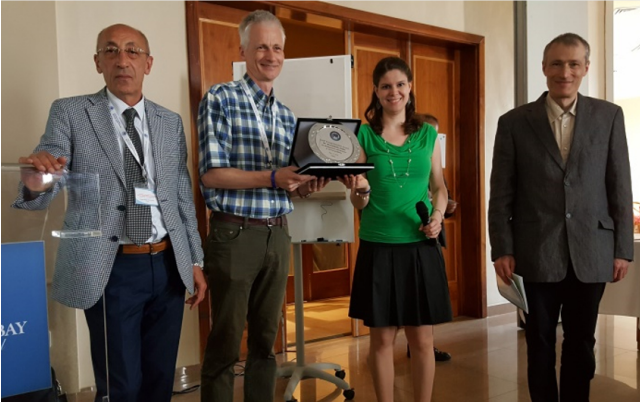


Figure 5: Young Scientist Award Ceremony: Prof. Alemdar Hasanov Hasanoglu, Prof. Otmar Scherzer, Dr Bernadette Hahn and Prof. Roman Novikov (from left to right).

linear problem of terahertz tomography,

- Prof. Masahiro Yamamoto (University of Tokyo, Japan): Mathematical analysis of inverse problems for coupling systems in fluid, viscoelastic dynamics.

A special issue of the *Inverse Problems in Science and Engineering* journal will be dedicated to this conference and will contain original research papers authored by the participants.

The IPMS 2018 meeting has proved to be highly beneficial, not only for the scientific exchanges between the participants, but also in terms of training opportunities for students and young researchers. Moreover, the conference also served to promote the research on inverse problems carried out at the University of Malta and to strengthen the reputation of the Department of Mathematics, the university, and the country in international fora.

The research on inverse problems at the University of Malta was revived since 2015 when Prof. Sebu joined the Department of Mathematics as Associate Professor in Biomathematics. Several students are currently pursuing postgraduate studies in inverse problems under Prof. Sebu's supervision: Nadia Vella (MPhil/PhD, Mathematics), Christopher Zerafa (MPhil/PhD, Geophysics) and Jeremy Curmi (MSc, Mathematics).

Apart from being the main driving force behind the organisation of the IPMS 2018 Conference, Prof. Sebu delivered an invited talk on “Deterministic methods for

conductivity imaging for skin and breast cancer detection”, and organised together with Dr Karel Van Bockstal (Ghent University, Belgium) and Prof. Liviu Marin, (University of Bucharest, Romania) the largest minisymposium of the conference, the minisymposium M21 Inverse Problems in Science and Engineering.

The minisymposium M21 Inverse Problems in Science and Engineering was aimed at bringing together well established scientists as well as young researchers working on inverse problems for partial differential equations to honour one of the experts in this field, Prof. Marian Slodička, on the occasion of his 60th birthday. The topics of the minisymposium ranged from the mathematical modelling and the theoretical analysis of inverse problems for partial differential equations where some parameters (right-hand side, kernel, diffusion coefficient, etc.), unknown boundary condition(s) or portion of the boundary are to be found, to the development of efficient numerical schemes and their practical implementations. The minisymposium featured 23 speakers from 21 international institutions: University of Cagliari (Italy), University of Lisbon (Portugal), Université Claude Bernard (France), Ghent University (Belgium), University of Caen-Normandie (France), University of Maryland (USA), Florida International University (USA), University of Goettingen (Germany), Goethe University Frankfurt (Germany), University of Oulu (Finland), Lodz University of Technology (Poland), Communication University of China (China), Clemson University (USA), University of Bucharest (Romania), Kocaeli University (Turkey), TU Dresden (Germany), University of Malta (Malta), K. N. Toosi University of Technology (Iran), University of Genoa (Italy), University of Utah (USA), and Military University of Technology (Poland).

Overall, the IPMS 2018 Conference in Malta was a great success both logistically and in terms of its contents: the perfect mix of cutting edge science, a very impactful attendee list and a spectacular location. Moreover, Malta proved to be the ideal venue for organising the future biennial IPMS Conferences, and has therefore become the hub for the international research community in inverse problems.

More details about the conference can be found on the conference website <http://www.ipms-conference.org/ipms2018/index.php>.

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