Contents
Malta Journal of Health Sciences Volume 6 – Issue 1 (June 2019)

Guest editorial

04 Digital health and education for Health Professionals
   Stephen Lungaro Mifsud, Physiotherapist and Deputy Dean, Faculty of Health Sciences

Research papers

05 Utilisation of services by informal caregivers of community-dwelling persons living with
   Dementia making use of the Dementia activity centres in the Maltese Islands
   Charmaine Spiteri and Charles Scerri

14 Local allele frequencies of the 5-HTTLPR serotonin transporter promoter polymorphism
   Christopher Grech, Stephanie Bezzina Wettinger and Rosienne Farrugia

Review article

22 Humour and Autism spectrum disorders
   Joseph Agius and Sandra Levey

Commentary

29 Meeting population dietary goals in Scotland and Malta: Shared challenges and opportunities for learning
   Lindsey P Masson and Claire Cooperstone
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The Malta Journal of Health Sciences disseminates research on a broad range of allied health disciplines. It publishes original research papers, review articles, short communications, commentaries, letters to the editor and book reviews. The readership of the journal consists of academics, practitioners and trainee health professionals across the disciplines of Applied Biomedical Science, Audiology, Communication Therapy, Community Nursing, Environmental Health, Food Science, Health Services Management, Medical Physics, Mental Health, Midwifery, Nursing, Occupational Therapy, Physiotherapy, Podiatry and Radiography.

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29  Meeting population dietary goals in Scotland and Malta: Shared challenges and opportunities for learning  
Lindsey F Masson and Claire Copperstone
The use of digital technologies for health has evolved into an inescapable form of intervention at all levels of health care practice. Digital Health, in all its complex interdisciplinary forms, has become both routine and innovative as it develops rapidly to meet the needs of the public, using technology from a growing number of fields, while inherently becoming a driving force for cutting edge technology. It offers promising interventions in health promotion, disease prevention and care in any given population. I would go further to suggest that the literal explosion of digital media and the welcomed global invasion of social media, has created an urgent demand for health professionals who are able to use and leverage new and emerging technologies to enhance personalised health care.

Today’s university students are digital natives. They have practically continual access to the internet and adopt technologies that they feel immediately are of use to them. Taking Malta’s case, how can we marry this phenomenon with the tidal wave of digital health interventions at our disposal, yet to be explored let alone used? Educators worldwide have recognised and embraced this phenomenon by designing course programmes that target general or specific issues or populations. Universities are sensitive to the needs of their surroundings, their country. They understand the responsibility of preparing the workforce of tomorrow today, melding art and science to create exciting futures. As the demands of the general public change, as people live functionally longer with co-morbidities, as advanced technology becomes available to the person at home or in hospital, the Maltese health workforce needs to evolve as fast as the changing technology they themselves use as private citizens. Since recognising the importance of digital health as far back as 2005, the WHO has published various guidelines and recommendations that attempt to steer governments, policymakers and individuals to adopt digital health concepts and increase the effectiveness of health interventions in this now mature digital age.

The use of wearables, artificial intelligence, big data, genomics would probably reduce or even remove the need for mass health screening of populations, for example. They may assist the physiotherapist, podiatrist, occupational therapist or community nurse select optimum intervention strategies with high expected outcome prediction levels, and all that data used in the intervention is fed back for possible algorithm modification. The radiographer may use Artificial Intelligence to assist in image quality. Virtual and augmented reality could be used as intervention platforms and advise (treat) the patient or client at home. The patient or client might want control of that intervention or might want to select the outcome desired. Hospital and clinic patient characteristics would change, the technology is here and is getting exponentially more accessible. The systems are relatively easy to build. Plainly, the raison d’etre of digital health is increased effectiveness of health interventions, to improve the quality of life of every person on this planet. In Malta, this will not happen if our medical, nursing and allied health students are not infused with all the facets that digital health involves, never losing sight of the goal, i.e., personalised health care and health for all; the vocation of the health professional to care for the person in need, care enhanced with digital technology. That is where health care is hurtling to.

The Faculty of Health Sciences (FHS) within the University of Malta would do well to ensure that artificial intelligence, data analytics and genomics become embedded in the undergraduate curricula of all its students. They are the guarantee that Maltese health systems remain successful in a fluid national and global environment. An FHS student would be the catalyst to increasing digital health literacy to the general public in all age groups, including those persons later in life. The University of Malta is rich in talent and research. We need to tap into those to educate and train health students to increase the effectiveness of their interventions, help make systems more efficient and relevant, and enable the Maltese citizen to take more responsibility for one’s own health. Artificial intelligence has been with us for a while now and Artificial General Intelligence is around the corner. What are we waiting for?
Utilisation of Services by Informal Caregivers of Community-Dwelling Persons Living with Dementia Making Use of the Dementia Activity Centres in the Maltese Islands

Charmaine Spiteri and Charles Scerri

Abstract. Dementia is one of the most important socio-medical conditions and public health challenges facing the Maltese informal and formal caregivers. In recent years, a number of services, including dementia-specific services, have been launched locally in order to assist persons living with dementia and their informal caregivers residing in the community. Although a number of these services have proved to be popular with informal caregivers, research on their utilisation and level of satisfaction is lacking. As a result, this study aimed to investigate service use and levels of service satisfaction of local informal caregivers of persons living with dementia. Data from 38 informal caregivers of community-dwelling persons living with dementia making use of the available Dementia Activity Centres was collected using a specifically designed questionnaire to determine which services were being utilised and the level of satisfaction on service use by informal caregivers. Persons living with dementia had a mean age of 76.7+/−6.1 years and were mostly living with their relatives. Informal caregivers had a mean age of 60.3+/−11.5 years, in the majority were daughters to the person living with dementia and had been in their caregiving role for more than five years. Results showed that caregivers mostly required assistance with bathing, handling of medication and transportation. Among the dementia-specific services available to persons living with dementia, caregivers mostly utilised the Dementia Activity Centres, the Dementia Wards at St. Vincent de Paul and the Dementia Helpline. Informal caregivers’ knowledge on dementia-specific services that were introduced following the launch of the National Dementia Strategy for the Maltese Islands were found to be lacking. In general, informal caregivers indicated a high degree of satisfaction with most of the services they utilised but unmet needs still subsisted. The findings demonstrated that although a number of services aimed at persons living with dementia and their caregivers are available, there is still lack of awareness of their existence. Such data can be useful to inform education and dementia practice and policy regarding the components required for the delivery of community-based dementia services aimed at bettering the quality of dementia care in the Maltese Islands.

Keywords: dementia, caregiving, community, services, knowledge

1 Introduction

Dementia is a clinical syndrome characterised by progressive deterioration of cognitive function beyond what might be expected from normal ageing (World Health Organisation, 2017). It mostly affects memory, orientation, comprehension, calculation, learning capacity, language and judgement. Alzheimer’s Disease International (2013) described dementia as the biggest global health challenge facing the current generation with projected worldwide figures of 75.6 million persons living with dementia by 2030. In 2015, it was estimated that there were 6,071 persons living with dementia in the Maltese Islands with this number expected to rise to 12,955 by the year 2050 (Scerri & Scerri, 2012).

Dementia is characterised by progressive deterioration of cognitive abilities. As a result, affected individuals become increasingly dependent on the care of others (Innes et al., 2011). As the severity of symptoms increases, so does the difficulty in performing activities of daily living and participation in social activities often leading to situations where care would be constantly required (Zwaanswijk et al., 2013). As the number of older persons continues to increase,
there will be even more demand for informal caregivers. Alzheimer’s Disease International (2012) rated dementia among the top ten most burdensome conditions among older persons worldwide. In contrast with other conditions, its impact comes mainly from years lived with disability, rather than years of life lost from premature mortality (Alzheimer’s Disease International, 2012).

In the majority of cases, care for persons living with dementia is provided by informal caregivers, typically a family member. Wimo et al. (2010) reported that the longer the person is provided with informal care, the less the costs to society. Supporting caregivers play an important part in preventing institutionalisation of persons living with dementia (Ervin & Reid, 2015) even though significant underutilisation of services for reasons such as lack of knowledge of the service, limited hours of service provision and cost or lack of availability has been reported (Xiao et al., 2013). In order to support caregivers in appropriate and supportive use of services, programme planners and health and social care service providers need a good understanding of the factors influencing use and non-use of services (Phillipson et al., 2014).

Within the local context, a wide range of services, including those specifically developed for persons living with dementia, are available (Scerri, 2015). These include the Memory Clinics, Dementia Rehabilitation Programme at Rehabilitation Hospital Karin Grech (RHKG), Dementia Intervention Team, Rehabilitation Wards (RHKG), Memory Classes (RHKG), Respite Care at St. Vincent de Paul (SVP), Dementia Activity Centres (SVP in Malta and Dar Padova in Ghajnsielem, Gozo), Dementia Helpline and services offered by the Malta Dementia Society, the latter being the sole national non-governmental organisation representing the voice of persons living with dementia (Scerri & Abela, 2006). Though not specific to dementia, persons living with dementia and their informal caregivers can also benefit from other services including the Community Geriatrician Services, Comcare (including Domiciliary Nursing, Occupational Therapy Service, Physiotherapy Service and Podiatry Service), Social Work, Home Help, Meals on Wheels, Telecare Plus, Continence Service, Night Shelters, Handyman Service, KartAnzjan and Telephone Rent Rebate. A full list of services is available online (Parliamentary Secretariat for Persons with Disability and Active Ageing, 2019).

Although utilisation of services by informal dementia caregivers in the community is essential in promoting their wellbeing and preventing early institutionalisation of the person living with dementia, to date, no study has been conducted locally on the utilisation of such services. Therefore, the main aim of this study was to investigate which services informal caregivers of community-dwelling persons living with dementia utilise. Furthermore, the level of satisfaction with the use of such services was also explored.

2 Methods

Fieldwork for this study was conducted in the Maltese Islands in October of 2017. Participants were all informal caregivers of community-dwelling persons living with dementia making use of the two available state-run Dementia Activity Centres located at SVP in Luqa, Malta (n=35) and at Dar Padova in Ghajnsielem, Gozo (n=15) at the time of the study. These Centres provide a safe, secure and dementia-friendly environment for persons living with dementia and who still reside in their communities. On agreeing to their participation and following an explanation of the objectives of the study, informal caregivers were handed a study information sheet, consent form and the study questionnaire. All documentation was available in both English and Maltese language and was distributed and collected by gatekeepers to secure anonymity. Translation of the questionnaire to the Maltese version was carried out by a graduate in translation studies. Piloting of the questionnaire was conducted with six caregivers who previously used the Dementia Activity Centres (three in both language versions). All agreed that the questionnaire was easy to understand and free from complex technical terminology that participants would find difficult to understand. The results of the pilot study were not included in the main study.

The questionnaire was adapted from Ervin & Reid (2015) and was divided into two sections. This adaptation included the addition of a number of services, a list of which is accessible online (Parliamentary Secretariat for Persons with Disability and Active Ageing, 2019), that were available to Maltese dementia informal caregivers but unavailable to the list of services in the population sample tested by Ervin & Reid (2015). The first section included sociodemographic data comprising gender, age, civil status, level of education, relationship with the person living with dementia, duration of caregiving in years, number of hours per day spent in caregiving, whether the caregiver was living with the person living with dementia, if the caregiver received information on services available for dementia caregivers upon diagnosis and whether they were aware that there was a National Strategy for Dementia in the Maltese Islands. Caregivers were also asked to select from a list of activities they help the person living with dementia with. These included bathing, taking medication, eating meals, walking, household tasks, food preparation, transport, shopping and administration of finances. Participants were also asked to provide sociodemographic data of the person living with dementia including gender, age, civil status, level of education and whether the person with dementia lives alone.

The second part of the questionnaire investigated the utilisation and level of satisfaction on services that were available for informal caregivers of persons living with dementia in the Maltese Islands. Response alternatives to a list of community services were (i) I use or have used this service; (ii) This service has been offered but I have not used it; (iii) I did not know about this service. A 5-point Likert-type scale rating from very unsatisfied (1) to very satisfied (5) was used to measure level of satisfaction of any utilised service.

The study was approved by the Faculty for Social Wellbeing Research Ethics Committee and by the University of Malta Research Ethics Committee following the approval from the Chief Executive Officer and Medical Superintendent of St. Vincent de Paul in Malta (for the Dementia Activity Centre in Luqa, Malta) and the Director of Active Ageing

https://www.um.edu.mt/healthsciences/mjhs/
and Community Care Directorate and the Dementia Activity Centre Coordinator (for the Dementia Activity Centre in Għajnsielem, Gozo). Participants were guaranteed confidentiality and anonymity and were free to withdraw at any stage without giving a reason. Written consent was obtained by all participants.

Analysis of data was conducted using the IBM® Statistical Package for Social Sciences (SPSS®) version 24.00. Descriptive statistics including mean data, standard deviations and percentages were used to describe sociodemographic data, service utilisation and level of satisfaction scores. Following data analysis for normality of distribution by the Shapiro-Wilk test, the data was found not to be normally distributed. As a result, sociodemographic and service use data were compared using the chi-square test. Service use level of satisfaction by informal caregivers was analysed with Kruskal-Wallis test followed by pairwise comparison. Cronbach alpha was utilised to determine the internal consistency of the research instrument. Mean data was expressed as a mean +/-SD (standard deviation). The significance level was set at 0.05.

### Results

#### 3.1 Characteristics of persons living with dementia and informal caregivers

Out of a total of 50 service users, 38 informal caregivers returned the questionnaire (response rate: 76%). Descriptive statistics of community-dwelling persons living with dementia and their informal caregivers are presented in Table 1. The majority of persons living with dementia were females, had a mean age of 76.7+/− 6.1 years (range: 67-90 years), were either married or in a domestic relationship, had primary level of education and were living with their relatives.

Informal caregivers were mostly females, had a mean age of 60.3+/− 11.5 years (range: 37-79 years), hailed from the Northern Harbour and Southern Harbour regions (for Maltese caregivers), were married or living in domestic partnership, had secondary level of education, were daughters of the person living with dementia, were caring for their relative with dementia for more than five years, spent more than 20 hours per day in caregiving, were living with the person living with dementia in the same household and indicated that they received information on available services upon diagnosis. Only 63.2% of informal caregivers were aware that a National Dementia Strategy was available in the Maltese Islands.

<table>
<thead>
<tr>
<th>Variables</th>
<th>PLWD (N=38)</th>
<th>iCG (N=38)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>Mean +/-SD</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>15 (39.5)</td>
<td>11 (28.9)</td>
</tr>
<tr>
<td>Female</td>
<td>23 (60.5)</td>
<td>27 (71.1)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>76.7+/− 6.1</td>
<td>60.3+/− 11.5</td>
</tr>
<tr>
<td>Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>2 (5.3)</td>
<td>8 (21.1)</td>
</tr>
<tr>
<td>Married/Domestic partnership</td>
<td>22 (57.9)</td>
<td>27 (71.1)</td>
</tr>
<tr>
<td>Widowed</td>
<td>14 (36.8)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Separated</td>
<td>0 (0.0)</td>
<td>3 (7.9)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>24 (63.2)</td>
<td>11 (29.0)</td>
</tr>
<tr>
<td>Secondary</td>
<td>13 (34.2)</td>
<td>16 (42.1)</td>
</tr>
<tr>
<td>Post-secondary</td>
<td>1 (2.6)</td>
<td>11 (29.0)</td>
</tr>
<tr>
<td>Relationship with PLWD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spouse</td>
<td>16 (42.1)</td>
<td></td>
</tr>
<tr>
<td>Son</td>
<td>4 (10.5)</td>
<td></td>
</tr>
</tbody>
</table>

https://www.um.edu.mt/healthsciences/mjhs/
### Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>PLWD (N=38)</th>
<th>iCG (N=38)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>Mean +/- SD</td>
</tr>
<tr>
<td>Daughter</td>
<td>17 (44.7)</td>
<td></td>
</tr>
<tr>
<td>Sibling</td>
<td>1 (2.6)</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td>Caregiving</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤1 year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;1-2 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;2-3 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;3-4 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;4-5 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;5 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of caring hours/day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;5 hours</td>
<td>3 (7.9)</td>
<td></td>
</tr>
<tr>
<td>5-8 hours</td>
<td>5 (13.2)</td>
<td></td>
</tr>
<tr>
<td>9-12 hours</td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td>13-16 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17-20 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-24 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No answer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living with PLWD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>31 (81.6)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>7 (18.4)</td>
<td></td>
</tr>
</tbody>
</table>

3.2 **Activities that informal caregivers need help with**

Bathing (94.7%), handling of medication (94.7%) and transportation (92.1%) were the three top activities that informal caregivers of persons living with dementia indicated that they needed help with. Activities such as helping their relative with dementia with feeding and to walk/stand up were indicated as the least in terms of need (60.5%; 65.8% respectively). As expected, and on considering the psychological burden associated with caring for person living with dementia, help with emotional support was also considered to be in high in terms of need (89.5%).

3.3 **Utilisation and service satisfaction by informal caregivers**

The use of available services together with the level of satisfaction about their utilisation by informal caregivers are shown in Table 2 and Table 3 respectively. Services that informal caregivers utilised the most included the Active Ageing Centres that are located across the Maltese Islands, St. Vincent de Paul and the Dementia Activity Centres. These were followed by KartAnzjan, the Pharmacy of Your Choice, the Dementia Wards located at St. Vincent de Paul, the Continence Service and the Telecare Plus. Services which caregivers used the least included the Geriatrician Services, Commcare and Social Work. Interestingly, informal caregivers were not using a number of dementia-specific services that were available and aimed at supporting them in their caregiving roles. These included the organisation of Memory Classes for individuals who have recently received a diagnosis of dementia and their informal caregivers, the Memory Clinics (Paola and Floriana Health Centres) and in the Rehabilitation Hospital Karin Grech, and the availability of the Dementia Intervention Team. However, most informal caregivers had knowledge about the availability of the Dementia Helpline.
Table 2. Utilisation of services by informal caregivers (N=38; ID: Identity Card, OT: Occupational Therapy, POYC: Pharmacy of Your Choice, PT: Physiotherapy, RHKG: Rehabilitation Hospital Karin Grech, SVP: St. Vincent de Paul). Cronbach alpha=0.884

<table>
<thead>
<tr>
<th>Service</th>
<th>Percentage (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I use or have used this service</td>
</tr>
<tr>
<td>Active Ageing Centres, Malta/Gozo</td>
<td>100.0 (38)</td>
</tr>
<tr>
<td>St. Vincent de Paul</td>
<td>71.1 (27)</td>
</tr>
<tr>
<td>Homes for the Elderly</td>
<td>10.5 (4)</td>
</tr>
<tr>
<td>Carer at Home Scheme</td>
<td>15.8 (6)</td>
</tr>
<tr>
<td>Commcare including Domiciliary Nursing, OT, PT and Podiatry services</td>
<td>7.9 (3)</td>
</tr>
<tr>
<td>Respite</td>
<td>18.4 (7)</td>
</tr>
<tr>
<td>Night Shelters</td>
<td>10.5 (4)</td>
</tr>
<tr>
<td>Home Help</td>
<td>15.8 (6)</td>
</tr>
<tr>
<td>KartAnzjan</td>
<td>92.1 (35)</td>
</tr>
<tr>
<td>Special ID</td>
<td>55.3 (21)</td>
</tr>
<tr>
<td>Social Work</td>
<td>7.9 (3)</td>
</tr>
<tr>
<td>Continence Service</td>
<td>47.4 (18)</td>
</tr>
<tr>
<td>Telephone Rent Rebate</td>
<td>21.1 (8)</td>
</tr>
<tr>
<td>Meals on Wheels</td>
<td>21.1 (8)</td>
</tr>
<tr>
<td>Telecare Plus</td>
<td>52.6 (20)</td>
</tr>
<tr>
<td>Handyman Service</td>
<td>10.5 (4)</td>
</tr>
<tr>
<td>POYC – Pharmacy of Your Choice</td>
<td>97.4 (37)</td>
</tr>
<tr>
<td>Dementia Helpline - 1771</td>
<td>29.0 (11)</td>
</tr>
<tr>
<td>Dementia Activity Center, SVP</td>
<td>71.1 (27)</td>
</tr>
<tr>
<td>Dementia Activity Centre, Gozo</td>
<td>28.9 (11)</td>
</tr>
<tr>
<td>Dementia Intervention Team</td>
<td>13.2 (5)</td>
</tr>
<tr>
<td>Dementia Wards, SVP</td>
<td>21.1 (8)</td>
</tr>
<tr>
<td>Memory Clinic, RHKG</td>
<td>15.8 (6)</td>
</tr>
<tr>
<td>Memory Clinic, Floriana Health Centre</td>
<td>7.9 (3)</td>
</tr>
<tr>
<td>Memory Clinic, Paola Health Centre</td>
<td>7.9 (3)</td>
</tr>
<tr>
<td>Memory Classes, RHKG</td>
<td>5.3 (2)</td>
</tr>
<tr>
<td>Geriatrician Services</td>
<td>7.9 (3)</td>
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<tr>
<td>Dementia Rehabilitation Programme, RHKG</td>
<td>10.5 (4)</td>
</tr>
<tr>
<td>Dementia Information Booklet</td>
<td>36.8 (14)</td>
</tr>
<tr>
<td>Guardianship Board</td>
<td>7.9 (3)</td>
</tr>
</tbody>
</table>
Among the services that were utilised by informal caregivers during their caring role, the respondents were mostly satisfied with Telecare Plus, the Active Ageing Centres, St. Vincent de Paul and the Special ID card. Among the dementia-specific services that informal caregivers used, all participants were satisfied with the Dementia Activity Centres.

Table 3. Level of satisfaction on service use by informal caregivers (ID: Identity Card, OT: Occupational therapy, POYC: Pharmacy of Your Choice, PT: Physiotherapy, RHKG: Rehabilitation Hospital Karin Grech, SVP: St. Vincent de Paul)

<table>
<thead>
<tr>
<th>Service</th>
<th>n</th>
<th>Unsatisfied</th>
<th>Neutral</th>
<th>Satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Ageing Centres, Malta/Gozo</td>
<td>38</td>
<td>0.0</td>
<td>12.6</td>
<td>97.4</td>
</tr>
<tr>
<td>St. Vincent de Paul (SVP)</td>
<td>27</td>
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<td>96.3</td>
</tr>
<tr>
<td>Homes for the Elderly</td>
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<td>25.0</td>
<td>25.0</td>
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<tr>
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<td>33.3</td>
<td>66.7</td>
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<tr>
<td>Commcare including Domiciliary Nursing, OT, PT and Podiatry services</td>
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<td>33.3</td>
<td>66.7</td>
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<td>7</td>
<td>14.3</td>
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<td>57.2</td>
</tr>
<tr>
<td>Night Shelters</td>
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<td>25.0</td>
<td>50.0</td>
</tr>
<tr>
<td>Home Help</td>
<td>6</td>
<td>0.0</td>
<td>16.7</td>
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</tr>
<tr>
<td>KartAnzjan</td>
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<td>2.8</td>
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<td>Continence Service</td>
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<tr>
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<td>Telecare Plus</td>
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<td>Handyman Service</td>
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<td>POYC – Pharmacy of Your Choice</td>
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</tr>
<tr>
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<td>25.0</td>
<td>75.0</td>
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<tr>
<td>Memory Clinic, RHKG</td>
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<td>16.7</td>
<td>83.3</td>
</tr>
<tr>
<td>Memory Clinic, Floriana Health Centre</td>
<td>3</td>
<td>0.0</td>
<td>66.7</td>
<td>33.3</td>
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<tr>
<td>Memory Clinic, Paola Health Centre</td>
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<td>50.0</td>
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<tr>
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<td>0.0</td>
<td>33.3</td>
<td>66.6</td>
</tr>
<tr>
<td>Dementia Rehabilitation Programme, RHKG</td>
<td>4</td>
<td>0.0</td>
<td>25.0</td>
<td>75.0</td>
</tr>
<tr>
<td>Dementia Information Booklet</td>
<td>14</td>
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<td>7.0</td>
<td>93.0</td>
</tr>
<tr>
<td>Guardianship Board</td>
<td>3</td>
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<td>33.3</td>
<td>33.3</td>
</tr>
</tbody>
</table>

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Service Utilisation by Dementia Caregivers

Statistical analysis on the relationship between service utilisation and informal caregivers’ and persons living with dementia demographic data indicated that the district demographic variable showed a strong significant effect on services including St. Vincent de Paul ($\chi^2(4)=38.000$, p<0.001), the Dementia Activity Centre in Luqa, Malta ($\chi^2(4)=27.495$, p<0.001), Commcare ($\chi^2(8)=22.862$, p=0.004), Telecare Plus ($\chi^2(8)=20.267$, p=0.009), the Dementia Wards at St. Vincent de Paul ($\chi^2(8)=23.886$, p=0.002), the Memory Clinic at Rehabilitation Hospital Karin Grech ($\chi^2(8)=23.256$, p=0.003) and the Memory Clinic at the Floriana Health Centre ($\chi^2(8)=21.839$, p=0.005).

Other important sociodemographic data that showed a significant effect on service utilisation included the caregivers’ civil status and the age of the person living with dementia. With respect to informal caregiver status, strong significant differences were found in Night Shelters ($\chi^2(4)=27.776$, p<0.001), with informal caregivers who had a separated status making use of the shelters more often than those who indicated that they were single (p=0.001) or in a married/domestic relationship (p<0.001). The Dementia Wards at St. Vincent de Paul was also found to show significant differences with informal caregiver status ($\chi^2(4)=15.202$, p=0.004).

The age of the informal caregiver had a significant impact on the Carer at Home Scheme ($\chi^2(4)=10.115$, p=0.039), Night Shelters ($\chi^2(4)=1.1586$, p=0.021), Memory Classes at the Rehabilitation Hospital Karin Grech ($\chi^2(4)=9.604$, p=0.048), the Dementia Rehabilitation Programme at the Rehabilitation Hospital Karin Grech ($\chi^2(4)=11.025$, p=0.026) and the Dementia Information Booklet ($\chi^2(4)=9.621$, p=0.047). Interestingly, a significant difference was reported between the informal caregivers’ relationship with the person living with dementia and the use of the Dementia Helpline ($\chi^2(6)=20.279$, p=0.002). Further analysis revealed that daughters (p=0.007) and sons (p=0.009) of persons living with dementia use or have used this service more often compared to partners/spouses.

Significant differences between satisfaction levels of services utilised by informal caregivers of persons living with dementia were observed ($\chi^2(29)=65.766$, p<0.001) denoting that informal caregivers participating in the study were more satisfied with a number of services compared to others. Pairwise comparison analysis showed that the service that informal caregivers indicated that they were very satisfied with was the Active Ageing Centres located across the Islands, followed by St. Vincent de Paul, the Special ID and the Dementia Activity Centres. Satisfaction levels for the Active Ageing Centres was significantly higher than the Homes for the Elderly (p<0.01), Carer at Home Scheme (p<0.01), Respite (p<0.05), Home Help (p<0.05), Social Work (p<0.01), Continence Service (p<0.01), Meals on Wheels (p<0.01), Dementia Wards at St. Vincent de Paul (p<0.05), Memory Clinic at the Rehabilitation Hospital Karin Grech (p<0.05), Memory Clinic at the Floriana Health Centre (p<0.05), the Dementia Rehabilitation Programme at the Rehabilitation Hospital Karin Grech (p<0.05) and the Guardianship Board (p<0.01).

Among the dementia-specific services available, informal caregivers were satisfied with the Dementia Activity Centres. Satisfaction levels for the Dementia Activity Centres of informal caregivers was significantly higher compared to the Homes for the Elderly (p<0.05), Carer at Home Scheme (p<0.01), Respite (p<0.05), Social Work (p<0.01), Continence Service (p<0.05) and Meals on Wheels (p<0.05).

### 4 Discussion

The main objective of this study was to investigate service utilisation and level of service satisfaction among informal caregivers of community-dwelling persons living with dementia making use of the available Dementia Activity Centres in the Maltese Islands. Although participants were overall satisfied with the services they use, the results also indicated that a number of services were not being utilised.

The age of persons living with dementia was found to play a significant role in a number of services including the Carer at Home Scheme, Night Shelters, Memory Classes, the Dementia Rehabilitation Programme and the Dementia Information Booklet. As the age of the individual with dementia increased, so did the use of the Carer at Home Scheme. This was expected as age is positively related to dependency in dementia and this can have a negative impact on the caregiver (Van Bruggen et al., 2016). The majority of participants in the >80-year cohort did not know about the availability of Memory Classes organised at the Rehabilitation Hospital Karin Grech. These classes are useful in communicating information about quality management and care at home to persons living with dementia and their caregivers following dementia diagnosis. It may be that the availability of such a service was not effectively being suggested to these individuals upon diagnosis and beyond and therefore greater public education is needed in accessing information regarding multi-modality management and care (Peterson et al., 2016). Interestingly, the oldest age cohort had good knowledge of the Dementia Information Booklet. This suggested that, in this particular cohort, printed information was the preferred method of obtaining information.

The majority of informal caregivers participating in this study were females. Although many countries are experiencing a shift in the incidence of male caregivers in dementia (Mc Donnell & Ryan, 2011), informal caregiving in the Maltese Islands is mostly regarded as an activity cared for by the female gender (Innes et al., 2011). Gender was found to have a significant effect on the Telephone Rent Rebate and the Telecare Plus services. Males were found to be less likely to use these services compared to females. Gender differences in caregiving among informal caregivers of persons living with dementia are well documented in literature (Pöysti et al., 2012). Whereas men consider caregiving more as a task, women may take it more comprehensively (Baker & Robertson, 2008). Furthermore, male caregivers are less likely to suffer as much as female caregivers with respect to burden denoting that the male gender seems to be protective when caring for a person with dementia (Pöysti et al., 2012).

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Informal caregivers of persons living with dementia mainly came from two age cohorts; the 50-59 years and the 70-79 years. The latter age cohort appears to comprise most informal caregivers of community-dwelling persons living with dementia in the Maltese Islands having been reported in two previous local studies (Gobey, 2013; Muscat, 2015). Interestingly, none of the informal caregivers in this age cohort indicated that they used or have used the Dementia Helpline. This was surprising on considering that telephone-based information and referral helplines are useful in disseminating knowledge about resources, especially to older caregivers of community-dwelling persons with cognitive impairment (Coyne, 1991). Furthermore, extended telephone contact increase the use of community services and decrease caregiver burden (Coyne et al., 1995).

Most of the informal caregivers were daughters, closely followed by spouses/domestic partners. These findings were in accordance with Muscat (2015) who also reported that the percentage of daughters caring for a parent with dementia in the community is high in the Maltese Islands. Studies suggest that daughters, acting as primary caregivers, have higher burden and are more likely to experience guilt (Romero-Moreno et al., 2014) and may have to relinquish or reduce employment to take up a primary caregiving role (Innes et al., 2011).

The data presented in this study showed that Maltese informal caregivers of persons living with dementia who attended the Dementia Activity Centre in Luqa, Malta mostly resided in the Southern and Northern Harbour districts, the latter being areas of close geographical proximity to this service. Interestingly, no caregiver of persons living with dementia who attended this Centre hailed from the Northern district. A possible explanation to this may be that the distance to the Dementia Activity Centre in Malta and significant delays in traffic encountered when using this service acted as limiting factors for Maltese caregivers. Although transport to and from the Dementia Activity Centre in Gozo was provided by the service provider at the time of study, such service was not available in Malta. While the transport of persons living with dementia may work where the distance is short, it can become a traumatic experience where larger distances are involved. The need of increasing the number of Dementia Activity Centres across the Maltese Islands, thereby reducing the distance taken by travel service users, is one of the recommendations included in the National Dementia Strategy launched in April of 2015 (Scerri, 2015).

Participating informal caregivers indicated that they mostly needed help with activities that included bathing, handling of medication and transportation. This was consistent with impairment of activities in daily living associated with mild to moderate dementia with the latter being the most common stage of dementia in individuals attending the Dementia Activity Centres in the Maltese Islands (Muscat, 2015). Assistance with activities associated with severe dementia such as feeding (Cohen-Mansfield et al., 1995) were the least indicated in need of support. Dementia is a progressive disorder which is accompanied by the need of a gradual increase in support in the conduct of activities of daily living. This progressive loss of independence in such activities is also associated with poorer quality of life (Andersen et al., 2004).

This research work had a number of limitations. Caregivers were selected amongst those using the Dementia Activity Centres and this may have affected the generalisability of the data. Caregivers who do not use the Dementia Activity Centres are difficult to identify for surveys and are therefore not represented in the present study. As a result, participants to this study do not necessary represent the perspectives of informal caregivers who are yet to actively seek support or that use other services. Although all caregivers making use of the Dementia Activity Centres were approached to participate in this study, leading to a high response rate, the sample size remained small and this may have affected statistical power. Moreover, caregivers that participated in this study was not a representation of the total population of informal caregivers of community-dwelling persons living with dementia in the Maltese Islands.

5 Conclusion
Dementia presents a significant challenge not only to those individuals who are affected but also to their informal caregivers, who in the majority of cases are relatives of the individual living with dementia. This study investigated the level of knowledge and degree of satisfaction of informal caregivers of persons living with dementia residing in the community on services intended to support them in their caregiving role. The results have indicated that although informal caregivers used and were satisfied with the provision of various services that were available, a number of dementia-specific services were still underutilised. This data can be useful to inform dementia practice and policy development regarding the essential components required for the delivery of community-based dementia services aimed at enhancing the quality of dementia care in the Maltese Islands.

6 Acknowledgments
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8 Conflicts of interests
The authors report no conflicts of interest.

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LOCAL ALLELE FREQUENCIES OF THE 5-HTTLPR SEROTONIN TRANSPORTER PROMOTOR POLYMORPHISM

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Abstract. The Serotonin Transporter protein (5-Hydroxytryptamine transporter; 5-HTT) is an important reuptake receptor of serotonin from the synaptic cleft. The protein is encoded by the SLC6A4 gene. A size polymorphism, the 5-HTT Linked Polymorphic Region (5-HTTLPR; SLC6A4, 44-BP INS/DEL), exists within the promoter of this gene. The presence of this polymorphism has been associated with an increased susceptibility for a variety of neurological conditions including Parkinson disease, chronic pain, anxiety and depression related phenotypes. This 5'S regulatory polymorphism consists of a 44-base pair insertion resulting in a long or short allele. The short allele is linked to a pronounced reduction in transcriptional efficiency producing lower numbers of transporter protein and a reduced rate of serotonin reuptake. Allele frequencies for this polymorphism show substantial variation in different populations. The frequency of the 5-HTTLPR in the population of Malta was determined in 608 cord blood DNA samples. Allele size difference of the 5-HTTLPR was detected using Polymerase Chain Reaction (PCR) and agarose gel electrophoresis. Intotal, 288 samples were found to be heterozygous (L/S) carrying 1 copy of the short allele and 1 copy of the long allele, while 129 samples were homozygous for the short allele (S/S) and 189 samples were homozygous for the long allele (L/L). Unexpectedly, 2 samples were found to carry a copy of the extra-long allele (XL) which is reportedly only found in African and Asian populations. Allele frequencies for L, S and XL alleles were 54.86%, 44.98% and 0.16% respectively. These local frequencies are similar to those of other European populations with the exception of the occurrence of the XL allele. These findings highlight the changing dynamics of population gene pools, the importance of selecting suitably matched controls for case-control studies and the importance of ethnicity information in the design, execution and interpretation of genetic diagnostic tests.

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1 Introduction

Serotonin (5-HT) is an inhibitory neurotransmitter with pleiotropic functions. It is required in adequate concentrations for mood stability and for balancing any excessive excitatory brain neurotransmitter secretions. Serotonin is also a regulator of several other processes which include carbohydrate cravings, sleep cycle and sleep (Jacobs, 1985), pain control and appropriate digestion (Yeo et al., 2004). Serotonin levels have also been associated with variations in function of the immune system (Mossner and Lesch, 1998). It has also been suggested that 5-HT is involved in the feeling of fear as well as pathological anxiety (Hariri et al., 2002). Furthermore, serotonin is an indolamine with vasoconstrictive and aggregating properties. It is considered a weak soluble platelet agonist, but with the ability to potentiate the aggregation induced by other agonists such as adenosine diphosphate (Baumgartner and Born, 1968; Gomez-Gil et al., 2002; Rand et al., 2003; Vanags et al., 1992). Thus, serotonin increases the procoagulant activity of activated platelets (Lopez-Vilchez et al., 2009).

In the central nervous system (CNS), serotonin is involved in the regulation of a variety of behavioural and visceral functions, including: mood, anxiety, aggression, gastrointestinal motility and vascular resistance (Kawautz et al., 2007). Its activity is implicated in many physiological functions (sleep, appetite and pain) as well as in pathological conditions such as depression and schizophrenia (Lesch et al., 1996; Lesch and Guteknecht, 2005). Furthermore, genetic polymorphisms within the serotonin reuptake transporter have been linked to many conditions such as pain perception (Hampf, 1989), psychiatric disorders such as mood, anxiety and depression (Kenna et al., 2012), Parkinson’s Disease (Zhang et al., 2014) and cardiovascular disease (Lopez-Vilchez et al., 2009).

The reuptake of 5-HT from cells and neurones is mediated by a specific transporter protein, the 5-Hydroxytryptamine Transporter (5-HTT), a sodium-dependent transporter protein that contains 12 trans-membrane spanning regions.
and enables the specific transport of 5-HT from the extracellular space of the synaptic cleft to the neuronal cytoplasm (Amara and Kuhar, 1993). It is the principal regulator of serotonin neurotransmission (Lesch and Morsner, 1998). Through its function, 5-HTT determines the level and duration of postsynaptic receptor-mediated signalling and acts as a prevention mechanism to hinder overstimulation or desensitisation of the sensorimotor responses. Thus, serotonin can be reutilised and is readily available to be transmitted to other receptors when stimulated (Hooten et al., 2013). The serotonin transporter protein is the main target of selective serotonin reuptake inhibitors (SSRIs) such as sertraline and paroxetine.

The gene encoding 5-HTT, Solute Carrier Family 6 Member 4, is located on chromosome 17q11.2 (Ramamoorthy et al., 1993). The promoter of 5-HTT contains a size polymorphism (the 5-HTT Linked Polymorphic Region; 5-HTTLPR) which gives rise to two common alleles differing by 44bp in size (Heils et al., 1996): a long allele (L) and a short allele (S) which have been shown in vitro to differentially regulate 5-HTT transcription and expression (Heils et al., 1996). The S allele has been shown to impair transcriptional efficiency resulting in decreased production of the transporter protein leading to a reduced re-uptake rate of serotonin from the synaptic cleft (Nakamura et al., 2000; Haberstick et al., 2015).

Allele frequencies for this polymorphism show substantial variation in different populations worldwide (Gelernter et al., 1999; Nakamura et al., 2000). Population studies of SLC6A4 suggest that the 5-HTTLPR genotype frequencies also show considerable variation across different ethnic groups (Willeit et al., 2003). It has also been suggested that the existence of at least two functionally different alleles in the promoter of SLC6A4 might reflect balancing selection, with certain beneficial traits balancing the negative outcomes of the anxiety-related phenotype (Gelernter et al., 1999). Since random genetic drift can also be used to explain the global variation in allele frequencies, any associations with the polymorphism can also be interpreted through an evolutionary perspective (Haberstick et al., 2015; Gelernter et al., 1999).

The allele frequency of the 5-HTTLPR serotonin transporter gene polymorphism in the Maltese population has never been determined. However, there is a general interest in this gene and its polymorphisms especially in relation to Parkinson’s disease, chronic facial pain and cardiovascular disease. Therefore, the current study was designed to determine the allele frequencies of the 5-HTTLPR in Maltese Population.

2 Methods

Study Population

Cord blood samples had been successively collected by the Malta BioBank over a 2-month period in 2010 to reflect the current population of Malta and Gozo. Cord blood was collected in Ethylenediaminetetraacetic acid (EDTA) vacutainers and frozen until required for DNA extraction. Extracted DNA was stored in the biobank for use in population studies (University Research Ethics Committee approval 48/2002). The cord blood collection was fully anonymised, however, the samples were coded into 5 subgroups: those from babies born to two Maltese parents (MT), 2 foreign parents (OO), 1 foreign and 1 Maltese parent (O) and samples from babies born in Gozo (G). Samples with incomplete parental details were denoted by ND. In this study, these different sub-groups are referred to as nation-based subgroups.

The study population included samples from 323 male and 307 female newborns. Of these, 305 samples were from infants with 2 Maltese parents (MT), 65 samples from infants with 2 foreign parents (OO), 75 samples from infants with 1 Maltese and 1 foreign parent (O), and 155 samples from infants whose parental details were incomplete (ND). The remaining 30 samples were from infants born at Gozo General hospital (G) and no parental details were available for these samples.

Genotyping

DNA had been previously extracted using the salting out technique (Miller et al., 1988). The primer sequences (Table 1) used to amplify the region surrounding the 5-HTTLPR were obtained from literature (Hooten et al., 2013).

| Forward Primer | 5' – TGGGTTTGCAGGGAAGATCCTG – 3' |
| Reverse Primer  | 5’ – TCCGCTTGGCGCTCTTCC – 3’ |

A master mix with 5µM primers (Bioneer, Korea), water and One Tag 2x PCR buffer (New England Biolabs, USA), was prepared for each set of samples to be tested and 9 µL mastermix was mixed with 1 µL DNA for each assay. Samples were tested in sets of 95 and a negative control was included with each set. PCR was carried out over 29 cycles with an annealing temperature of 60°C. Sizing of PCR products was carried out on a 1.5% agarose gel.

DNA Sequencing

Two samples of each different genotype were selected for dideoxy sequencing. Prior to sequencing, PCR products were cleaned using a PCR purification kit (Accuprep® Bioneer, Korea). Sequencing was carried out at LGC Genomics (Germany). Sequencing data was viewed using Chromas v2.4.4 (Technelysium Pty Ltd.) and aligned using Sequencher v5.4.1. PolyPeakParser (http://yosttools.genetics.utah.edu/PolyPeakParser/) was used to de-convolute the sequences of the different alleles in heterozygous samples (Hill, 2014).

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Data Analysis

The population was tested for Hardy Weinberg Equilibrium (HWE) using the HWTriExact function in R v3.6.0 (RCore Team, 2013). The HWTriExact function is an exact test for HWE for triallelic variants and is part of the HardyWeinberg R package (Graffelman 2008; Graffelman 2015). Allele and genotype frequencies for the whole collection of samples and for different nation-based subgroups were calculated. These frequencies were compared to European American, African American and Asian cohort data. The Mann Whitney two-tailed test was used to compare genotype frequencies between males and females.

3 Results

Genotyping results were obtained for 608 samples (Figure 1, Table 2). From the data collected during this study, 47.37% of the Maltese population was found to be heterozygous (L/S). 31.09% were homozygous L/L and 21.22% were homozygous S/S. Unexpectedly, two individuals (0.32%) were found to be heterozygous for the 20-repeat XL allele as confirmed by Sanger sequencing (Appendix A). Allele frequency for S, L and XL alleles were 44.98%, 54.86% and 0.16% respectively. The 2 samples carrying the XL allele were both offspring of 2 foreign parents (OO).

![Image of genotyping results](https://www.um.edu.mt/healthsciences/mjhs/)

Figure 1. Genotyping results of representative samples from the study population. Lanes 1 and 11 show the 100bp ladder. Lanes 2 and 3 show L/Sheterozygotes, lanes 4 and 5 show L/L homozygotes, lanes 6 and 7 show S/S homozygotes and lanes 8 and 9 show the XL/L and XL/S genotype respectively. Lane 10 shows the negative control. The PCR products observed are of expected size of 466bp for the S allele and 509bp for the L allele. Lanes 8 and 9 both show the XL band which is larger in size.

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Overall N (%)</th>
<th>MT N (%)</th>
<th>OO N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L/L</td>
<td>189 (31.09)</td>
<td>81 (26.53)</td>
<td>19 (29.03)</td>
</tr>
<tr>
<td>L/S</td>
<td>288 (47.37)</td>
<td>166 (54.42)</td>
<td>33 (51.61)</td>
</tr>
<tr>
<td>S/S</td>
<td>129 (21.22)</td>
<td>58 (19.05)</td>
<td>10 (16.13)</td>
</tr>
<tr>
<td>L/XL</td>
<td>1 (0.16)</td>
<td>0 (0)</td>
<td>1 (1.61)</td>
</tr>
<tr>
<td>S/XL</td>
<td>1 (0.16)</td>
<td>0 (0)</td>
<td>1 (1.61)</td>
</tr>
</tbody>
</table>

Table 2: Allele and genotype frequencies for 5-HTTLPR in the different subgroups

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Notwithstanding the unexpected XL alleles, the study population was found to be in HWE. The allele frequencies for both genders indicate no gender bias and HWE testing of the MT and the OO subgroups showed that the subgroups representing the local gene pool (MT) and the immigrant gene pool (OO) are both in HWE.

Allele frequencies for the Maltese population were found to be comparable to the allele frequencies of neighboring European populations (Figure 2), that is, a higher proportion of heterozygous individuals with homozygous L/L observed more than homozygous S/S.

**Figure 2.** 5-HTTLPR genotype frequencies in Maltese, European, Asian and African populations. Results from the Maltese population are closest to the European populations with the exception of the presence of the XL allele which is typically found, albeit rarely, in African, Asian and non-white Hispanic populations. (European, Asian and African population data obtained from: Gonzales-Vigil, 2015).

### 4 Discussion

Genetic demographic data shows a greater population frequency of the 5-HTTLPR S-allele within certain geographical regions of the world such as East Asia. In a typical East Asian population, 70–80% of individuals carry the S allele compared to a typical European population where only 40–45% of individuals carry the S allele (Gelernter et al., 1997; Nakamura et al., 2000). Conversely, African populations have a higher frequency of the L-allele when compared to European and Asian populations (Haberstick et al., 2015). One possible explanation for the differences in allele and genotype frequencies between different geographical populations is that geographical variability and environmental pressures have influenced genetic selection (Chiao and Blizinsky, 2010).

The genetic diversity between human populations shows clear variation with respect to geographical distance and geographical barriers, because individuals from more distant populations are less likely to interbreed with each other than individuals from less distant populations due to isolation by distance. This separation hence affects the rate of interbreeding with other populations which can be overcome through freedom of movement. European and Asian genetics have until recently been characterized by distinctive isolation by distance due to geographical barriers. Europeans are on average, more closely genetically related to the Middle-East rather than to Central and East Asians (Eisenberg and Hayes, 2011). This may imply that even with no natural selection, the historical relationship between populations has created a variation in allele frequencies moving from Western Europe into East Asia (Eisenberg and Hayes, 2011).

In the representative sample of the Maltese population studied, 2 individuals showed the possession of an XL allele consisting of 20 repeats with a genotype and allele frequency of 0.32% and 0.16% respectively. Other uncommon alleles longer than the L allele have been previously reported in other populations (Delbruck et al., 1997; Gelernter et al., 1997; Kunugi et al., 1997; Nakamura et al., 2000; Narita et al., 2001). Murdoch et al., (2013), studied 2500 individuals from 47 populations distributed globally for 5-HTTLPR frequencies that may reflect the migration patterns from Africa and Asia into Europe and America. The vast majority of the tested individuals carried the 14 and/or 16 repeats; the S and L alleles respectively. Additionally, two different 20-repeat alleles which had been previously observed in the Japanese (Nakamura et al., 2000; Frisch et al., 2000) and in individuals of African ancestry (Delbruck et al., 1997) were observed in East Asian populations. Alleles showing the 20-repeat pattern were also seen in two West African populations (Yoruba and Hausa), in the Durne population of Southwest Asia and in the Chagga from East Africa (Murdoch et al., 2013).

Hence, the presence of the XL allele in the Maltese population can be reasonably attributed to migration from African and/or Asian populations which has led to the introduction of this allele into the local gene pool. This is further supported by reports that no XL allele was identified in European populations (Noskova et al., 2008; Nonnis Marzano et al., 2008; Fumerton et al., 2002; Willeit et al., 2003; Gutierrez et al., 1998; Surtees et al., 2006; Szekely et al., 2004; Lang et al., 2004) and in adult Maltese populations (Muscat, 2017; Muscat, 2018).

The introduction of new alleles in the local gene pool is not a novel occurrence. A number of studies report potential historical founder effects (Kozieł et al., 2002; Farrugia et al., 2007; Vidal et al., 2009) through which specific gene

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variants were introduced into the gene pool of the Maltese population and subsequently spread through the population during a phase of population growth. These findings highlight the changing dynamics of population gene pools, the importance of selecting suitably matched controls for case-control studies and the importance of ethnicity information in the design, execution and interpretation of genetic diagnostic tests.

5 Conclusion
In conclusion, the allele frequency distributions of the 5-HTTLPR size polymorphism in the Maltese population are similar to the frequencies reported in other European populations, with the addition of the XL allele. This highlights the need for clinician and healthcare service providers to be prepared for the occurrence of conditions not previously encountered in the local population.

6 Acknowledgements
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8 Conflicts of Interest
The authors report no conflicts of interest

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APPENDIX A

Appendix A. (A) Sequence of the 20-repeat XL allele extracted from sanger sequencing data using PolyPeakParser (Hill et al., 2014) showing the sequence of the XL allele. (B) Sequence of the amplified XL fragment. The yellow highlighted nucleotides show primer regions, blue nucleotides show the 44 base pair insertion of the L allele and the green highlighted nucleotides show the longer sequence found in the XL allele.
Humour and Autism Spectrum Disorders

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Abstract. Humour is universal and one of the most important topics in the study of communication. Humour is also a crucial and essential component in many different contexts of everyday life. One population that encounters difficulties with humour individuals with Autism Spectrum Disorders (ASD). This article describes the factors that play a role in understanding humour for individuals with ASD. A review of articles is presented that focuses on the comprehension of humour. Humour-training intervention for individuals with ASD is also discussed.

Keywords: Autism Spectrum Disorder (ASD), humour, intervention

1 Introduction

Humour is an essential element in everyday life. School-age children use humour to form relationships, to celebrate life through expressions of laughter, to play with words, and as a way of coping with growing up and daily life stress (Dowling, 2013). The effective use of humour can build relationships, improve the quality of life, and promote positive well-being (Martin, 2007). This article explores research that focuses on individuals with an Autism Spectrum Disorder and the effect that this condition has on their ability to detect and comprehend humour. Individuals with ASD have difficulty with social communication and interaction as well as social reciprocity (Diagnostic and American Psychiatric Association, 2013). In addition, individuals with ASD have difficulty with novel situations and social interests.

Early research found that individuals with ASD have difficulty detecting and understanding humour (Asperger & Frith, 1991). However, they have better ability with humour found in slapstick comedy and the less complex language found in simple jokes (Ricks & Wing, 1975). Difficulty in understanding jokes could be mainly due to literal understanding of irony and sarcasm, as well as difficulty with resolving incongruities.

2 Humour Categories

There are several categories of humour: puns, riddles, and nonsense jokes. A pun is a joke that makes use of the different possible meanings of a word (e.g., A skunk fell in the river and stank to the bottom). Riddles contain words that may be used in an unexpected manner (I have a face and two hands, but no arms or legs. What am I? A clock). Nonsense jokes may appear at younger ages (e.g., Knock-Knock. Who’s there? Banana. Banana who? Banana peel). Some jokes contain homophones, i.e. words that sound the same (e.g. What did the chess piece say before bed? Knight knight). Humour that features homophones creates difficulty for individuals with ASD. However, nonsense jokes generally lack homophones, allowing individuals with ASD to better understand these jokes (Wu et al., 2014).

There are different types of homophones (Literary Devices, 2018). Homographs are words that are spelled the same but have different meanings (e.g., hail as in an ice storm and hail as used in a greeting); homonyms are words with the same pronunciation but different meanings (e.g., cite, sight, site); heterographs are words that have different spellings but are pronounced the same way (e.g., write-right); and ononyms are words or phrases that sound similar to each other (e.g., ice cream—I scream). Nonsense jokes often lack homophones. Given the absence of homophones in nonsense jokes, they are better understood by individuals with ASD (Wu et al., 2014). There are also four humour styles that play a significant role in social interaction.

3 Humour Styles and Social Interaction

There are four humour styles that are relevant for psychosocial well-being (Martin, Puhlik-Doris, Larsen, Gray & Weir, 2003). The Humour Style Questionnaire (HSQ) was developed as a self-report questionnaire to assess these four humour styles. The two main functions are enhancing

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oneself and enhancing relationships with others. This can be achieved adaptively (affiliative and self-enhancing) or maladaptively (aggressive and self-defeating). Affiliative humour is used in supporting group interrelations, such as jokes and humourous comments. Self-enhancing humour is used for stressful circumstances. Affiliative and self-enhancing humour are typically found to be positively correlated with self-esteem and negatively correlated with depression and anxiety. In contrast, self-defeating humour is associated with high levels of anxiety and depression and with low self-esteem (Martin et al., 2003). Aggressive humour involves put-downs or insults targeted toward individuals (If you think people are laughing at you, they probably are).

Fox, Dean and Lyford (2013) looked at the use of the HSQ with children. Surprisingly, self-enhancing humour was unrelated to measures of psychosocial adjustment. Aggressive humour was associated with measures of psychosocial adjustment but there were some important gender differences. For boys, use of aggressive humour was associated with high self-perceived social competence and lower anxiety. However, for girls, it was linked with lower global self-worth and higher depression.

4 Understanding Humour in Figurative Language

Figurative humour contains abstract language that expresses irony or a meaning that requires understanding of words that are different from literal meaning. An idiom is an expression with a meaning that cannot be identified by the words that are used. Some idioms are transparent (e.g., Don’t trust them as they will stab you in the back), and may be more easily understood. There are also idioms that are opaque (e.g., They are barking up the wrong tree). The opaque idioms are less well understood by younger children (Nippold & Duthe, 2003). Similes make a comparison between two different subjects (e.g., He is as stubborn as a mule), which requires understanding word meanings and entities’ characteristics. Metaphors make a comparison between two unrelated entities (e.g., The exam was a breeze).

Children aged 5–12 were studied for their comprehension of idioms (Whyte, Nelson & Scherf, 2014). Their syntax, vocabulary, and theory of mind (TOM) abilities were assessed, and children were placed into three groups: 26 children with ASD, 26 typically developing (TD) children matched on chronological age, and 26 TD children matched on syntax age-equivalence but not on chronological age. Children were presented with idioms and answers to assess their understanding. An example of one of the idiom stimuli follows.

I was supposed to go to my friend’s house after school on Friday. However, I didn’t make it to my friend’s house because it slipped my mind.

Children were given possible answers to assess their comprehension of the idiom (p. 130):

You forgot about it (correct answer)
You don’t think about it (related figurative answer)
Slip on soap or banana peel (literal answer)
Slipped your mind (restated answer)
I had to do chores (not related).

Findings showed that children with ASD had difficulty comprehending idioms compared to the TD age-matched group. However, the children with ASD showed comparable comprehension with the TD syntax group, showing that linguistic abilities play a role in understanding idioms. Findings also showed that both linguistic and advanced TOM abilities supported children with ASD’s understanding of idioms.

Pexman, Rostad, McMorris, Clinie, Stowkowy and Glenwright (2011) examined the processing of ironic language for ASD high-functioning children. This study consisted of three groups aged 7;8 to 11, including 18 high-functioning children with ASD, 18 TD children matched with the children with ASD’s verbal ability, and 18 TD children matched to the children with ASD for chronological age. Puppets were used to show familiar activities (e.g., hide and seek). In one example, one puppet kicked a ball and scored and the other puppet commented either that it was a terrible play (ironic comment) or a great play (literal comment). The speakers’ tones conveyed literal (great play) or ironic intent or criticism (terrible play) or compliment (great play). Findings showed that ASD high-functioning children were able to comprehend irony, most likely due to the speakers’ tone (literal vs. ironic). However, children with ASD did not understand that ironic critiques (terrible play) were intended to be humourous, suggesting that these children did not truly understand a speaker’s intent. This ties in with the fact that TOM is affected in individuals with ASD.

Another study of children with ASD’s understanding of humour presented children with two types of sequenced pictures: literal-literal (a sequence in which a neutral picture was followed by a neutral picture) and literal-humourous (in which a humourous picture followed a neutral picture) (Silva, Da Fonseca, Estevés & Deruelle, 2017). Children and young adults were placed in two groups that consisted of 20 children and young adults with ASD, age 11–20, and 25 TD children and young adults, age 10–22. Participants were presented with stimuli that consisted of objects, landscapes, characters, animals, and actions. Findings were that the participants with ASD responded similarly to the TD participants, as long as the stimuli did not reflect social cues. In other words, there was greater appreciation for the stimuli that portrayed animals rather than humans. This finding showed that the understanding of participants with ASD was more successful for non-social rather than for social actions or events. This study also showed that social interaction abilities also depend on TOM skills to understand speakers’ intents.

Wuet al. (2014) examined 177 high school-aged with ASD and 177 TD children’s abilities to comprehend nonsense and incongruity-resolution jokes. Humour consisted of affiliative, self-enhancing, aggressive, and self-defeating humour, along
with nonsense jokes and incongruity-resolution humour stimuli. Affiliative humour is characterized by its use in promoting group cohesion through jokes and making fun of things that are humorous to all. Self-enhancing humour involves finding humour in a stressful situation. Aggressive humour is marked by sarcasm, teasing, and ridicule of others. Self-defeating humour involves putting yourself down to gain approval from others. Nonsense jokes are those that employ absurdities to create humour (e.g., "What does a grape say when you step on it?" "Nothing. It just gives a little whine."). Incongruity involves an unexpected shift of outlook, such as an event or story resulting in an illogical conclusion or action. Examples of the stimuli used in this study follow (p. 1389).

Affiliative humour: I don’t have to work very hard at making other individuals laugh — I seem to be a naturally funny person.

Self-enhancing humour: If I am feeling depressed, I can usually cheer myself up with humour.

Aggressive humour: If someone makes a mistake, I often tease them about it.

Self-defeating humour: I often try to make individuals like or accept me more by saying something funny about my own weaknesses, mistakes, or faults.

An example of a nonsense joke that was used in this study follows.

A Chinese unicorn leaves home and flies northwards. He flies to the Arctic where it is so cold that he becomes an ice cream. His two younger brothers don’t know where to find him. So, they walk southwards. Finally, they arrive at the South Pole and become self-served ice cream (Note: unicorn and ice cream have the same pronunciation in Chinese).

Examples of incongruity-resolution jokes follow. In this type of humour, there is an unexpected shift in perspective (Boyd, 2004). Humour is understood when the listener becomes aware of the incongruity between a concept involved in a certain situation and the real objects thought to be in some relation to the concept. The cognitive ability to detect this type of humour involves the incongruence between a punch line and experience with the concept used in the joke.

I went to a general store. They wouldn’t let me buy anything specifically.

Why do birds fly south in winter? It’s too far to walk.

Children with ASD did not comprehend nonsense and incongruity-resolution jokes at the same rate as TD students. However, the children with ASD did enjoy nonsense jokes that required less logical reasoning and lacked homophones that required understanding meaning. There was equal comprehension of the aggressive humour stimuli for the groups with ASD and TD. This finding is consistent with the theory that the humour associated with individuals with ASD is more aggressive (Asperger, 1944). This may be based on poor mind reading skills (Eriksson, 2013). The absence of mind reading abilities may result in less sensitivity to other people’s emotions or feelings (Samson, Huber & Ruch, 2011).

Kana and Wadsworth (2012) examined neural responses associated with puns in a functional magnetic resonance imaging (fMRI) study. Participants consisted of high-functioning ASD and TD individuals, 16–35 years of age. A pun is a joke that makes use of the different possible meanings of a word. Examples of puns used in this study consisted of My advanced geometry class is full of squares and To write with a broken pencil is pointless. Findings showed an overall activation in brain activity for participants with ASD, mainly within the right hemisphere and in the relatively posterior brain area. However, there was a decrease in activation in the left hemisphere for the participants with ASD compared with the TD participants. The lack of activation in the left hemisphere may affect the comprehension of ambiguous meaning associated with figurative humour language. The ability to understand abstract language meanings is essential for the comprehension of figurative language humour.

Jones (2009) found that children with ASD produce and appreciate humour to a limited extent based on simpler examples of humour (i.e., rhyme, slapstick, and funny sounds). An interesting study by Weiss et al. (2013) examined whether children with Asperger’s syndrome differ from typically developing children in appreciation of simple slapstick humour. Slapstick humour involves some type of boisterous action, such as visual actions (throwing pies in someone’s face or other silly actions). Short slapstick scenes and matched non-humourous control scenes were extracted from the animated movies Ice Age and Madagascar. Twenty-four boys with Asperger’s syndrome and 24 age-matched TD controls were tested. Results showed that children with Asperger’s syndrome enjoy humorous material as much as typically developing children.

A visual study in which cartoons (line drawings) were presented to adults with Asperger’s Syndrome (Samson & Hegenloh, 2010) showed possible difficulty with visual perception. In this study, line drawings may have tempted the participants to focus on visual details rather than on the whole picture. According to Loukusa and Moilanen (2009), individuals with ASD often do not use contextual cues to understand the meaning of what they see. The Theory of Weak Central Coherence proposes that individuals with ASD focus on details rather than a coherent whole. This theory would thus also explain their performance in Samson and Hegenloh’s study.

A study by Samson and Antonelli (2013) examined the importance of humour in individuals with Asperger’s Syndrome/High Functioning Autism (AS/HFA) and how it relates to life satisfaction and happiness. Thirty-three individuals with ASD were matched with typically developing (TD) participants. Participants filled out scales assessing
character strengths, life satisfaction, and orientation to happiness. Humour was found to be the 8th highest out of 24 character strengths in TD, but only at the 16th position in individuals with ASD. For the TD participants, humour was related to life of pleasure, life of engagement, life of meaning, and life satisfaction. For individuals with ASD, humour was only related to life of pleasure.

5 Humour Intervention for Individuals with Autism Spectrum Disorders (ASD)

5.1 The Comprehension of Affiliative, Self-enhancing, Aggressive, and Self-defeating Humour

Wu et al. (2016) developed a training program for adolescents with ASD who were placed into an experimental group and a control group. Training focused on affiliative, self-enhancing, aggressive, and self-defeating humour (described earlier in this paper). Examples of other training stimuli follow, beginning with a nonsense joke and followed by an incongruity-resolution joke (p. 27).

A male deer is walking in a vast forest alone. While walking, it begins running faster and faster and finally becomes a highway (In Chinese, "highway" and "deer" are pronounced in the same way).

After dinner, a mother and daughter are washing dishes, and the father and son are watching TV in the living room. Suddenly, there is the sound of broken dishes. After a moment of silence, the son tells the father that his mother must take responsibility for the broken dishes. The father asks, "How do you know?" The son replies, "My mother did not scold anyone."

Findings were that the comprehension of nonsense humour increased in the experimental group, with less progress for incongruity-resolution humour. Incongruity presents difficulty in that the comprehension of this type of humour involves two stages (Vrticka, Black, & Reiss, 2013): comprehension and appreciation. In the first stage, the listener must be able to detect incongruity. In the second stage, the listener must be able to integrate the new information with a positive emotional response. This process is supported by cognitive, emotional, psychological, and social abilities (Martin, 2007), along with the ability to recognize incongruity. These factors may play a role in the difficulty found in individuals with ASD for comprehending incongruity, given the absence of TOM. Following training, the ASD participants utilised affiliative humour. This is an essential type of humour when interacting with others as it involves promoting group cohesion through the use of humour appreciated by all.

A factor that may play a role in assessment or intervention is that individuals with ASD may lack global or integrative processing (i.e., processing or consideration of a whole entity or a scene) (Simmons et al., 2009). Instead, there is a detail-based style that may not allow for the processing of a full scene (Happé & Frith, 2006). This may affect an evidence-based assessment or intervention of humour when employing visual stimuli. In this case, clinicians can assure that the ASD individual is able to view all the details in a picture and process the visual details. Clinicians should also assess and focus on syntax and TOM abilities (Whyte et al., 2014). In this way, the individuals with ASD will better understand listeners. Clinicians can also teach individuals with ASD to decode word meanings (Kana & Wadsworth, 2012), and teach them words that have similar sounds but different meanings (e.g., ate-eight, write-right, and bare-bear). Better understanding of ASD will help clinicians find the strategies that will support these individuals' understanding of humour.

5.2 The Comprehension of Irony

An intervention study examined the comprehension of irony by adults with ASD (Saban-Bezalel & Mashal, 2015a), in addition to the study of hemispheric processing of irony. Irony is a type of figurative language often involved in humour and criticism, as in the example of the mother's comment on her child's room. The mother's utterance is ironic because it is based on the fact that the child's room is very messy.

"You should win an award for your clean room."

Participants consisted of 29 adults with ASD and 22 typical adults, with all participants assessed with non-verbal intelligence and vocabulary tests. Initially, all participants were given a questionnaire that contained passages intended to assess their understanding of irony. An example of an ironic passage follows.

"Dan wanted to lose weight and consulted a nutritionist. The nutritionist recommended an appropriate diet and suggested that he begin exercising. Dan likes eating and hates physical activity, and so he did not follow these recommendations. The nutritionist was frustrated with Dan's lack of progression. On their last meeting, she weighed Dan and saw no change. She then said: 'Wonderful Dan, keep it up!'"

In the intervention phase, adults with ASD viewed irony used in videos, stories, and comic strips. Each clip displayed a situation that ended with an ironic expression. Intervention was based on small groups of 3 to 5 members, with sessions lasting for 30-45 minutes once a week for five consecutive weeks. Sessions began with the introduction of figurative language and irony, with focus on the use of irony in social contexts. Each session presented videos, with participants asked to identify irony in the videos. The sessions also presented participants with short stories that had open endings. Participants were asked to produce either a literal ending or an ironic ending to each story.

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Participants were also asked to describe situations that contained irony. Following this intervention, participants completed the same irony questionnaire. Findings were that adults with ASD showed significant improvement in irony comprehension.

The same study examined hemispheric processing by the adults with ASD, using the approach of Saban-Bezalel and Mashal (2015b). This approach employed a divided visual field paradigm (DVF) based on the anatomy of the visual system. In this paradigm, stimuli presented to one visual field are transmitted to the opposite hemisphere only. This makes it possible to stimulate each hemisphere separately. Visual stimuli presented in the right field are projected to the left visual cortex. In the current study, participants were presented with 28 ironic passages, 28 literal passages, and 28 meaningless passages. Each passage could be completed with one of these interpretations (ironic, literal, or meaningless). The following example presents one of the experimental passages, with the ironic ending consisting of the word "perfect."

"Exhausted after a long day at work, David planned to go to bed early. Just as he was ready for bed, he heard a knock on the front door. David opened the door and saw that some friends came by for a visit. David said: "The timing is...".

Participants sat in front of a computer screen. A fixation point appeared at the center of the screen, followed by the appearance of the passage. Next, a fixation point was presented followed by the appearance of the target word. Target words were presented at the right or the left of the fixation point, with processing occurring either in the LH or the RH. When stimuli are presented to the left visual field (LVF), processing occurs in the RH, while information presented in the right visual field is processed by the LH. Findings were that intervention led to hemispheric processing changes in the ASD participants. Following intervention, ASD participants exhibited faster responses for ironic targets relative to literal target words when stimuli were presented to the RH. Findings have shown that adults with ASD process stimuli bilaterally (Saban-Bezalel & Mashal, 2015b). However, processing figurative language with the RH might be less efficient than with the LH. Thus, the intervention study showed that there was a positive change in the abilities of the adults with ASD to process irony, based on the results of the questionnaire and the hemispheric finding. This is an important finding given that irony is encountered frequently in communication.

5.3 The Understanding of Lexical Humour

An intervention study focused on the understanding of lexical humour by children with autism (Gill, White & Allman, 2011). Lexical humour is based on words with multiple meanings that are frequently found in riddles. Participants consisted of six high-functioning children with autism ranging from 10 to 13 years of age. Prior to intervention, participants were presented with a set of 175 multiple-meaning words followed by a set of six pictures, with vocabulary based on progressive difficulty. In this programme, participants were asked to point to two pictures that corresponded to the meanings for a target word that was printed at the top of the page. This word was also read to participants to assure their understanding. If participants pointed to only one picture, they were asked to point to the other picture that corresponded to the meaning of the target word. This task was administered until children were able to identify at least 40 words that were selected for two meanings and 40 words that children could not identify as having two meanings. Children were then presented with a set of riddles in the Baseline Humour Pool that included multiple-meaning words, as shown in a riddle from this pool.

Where do snowmen keep their money?
(a) They don't have any money.
(b) In a purse.
(c) In a safe.
(d) In snow banks.

Assessment was followed by teaching children riddles. Instruction consisted of the instructor reading a riddle and circling the associated meaning. Then, it was explained that the target word could be used in two ways. Next, children and instructor made up a sentence using the first meaning of the word. This approach was then used for the second meaning of the word. Children were also asked to draw a picture that illustrated these meanings. Children attended speech-language sessions, with half of sessions devoted to riddle comprehension. Findings were that children made gains in their comprehension of multiple meanings and in their ability to understand lexical riddles. These findings suggest that intervention should consider the use of lexical riddles for developing a better understanding of humour by children with autism.

6 Discussion

Humour can be seen as a social glue that helps to foster relationships (Samson, 2013). A better understanding of humour in individuals with ASD helps us understand emotions in ASD. In addition, it is important that we understand which cognitive, social, and affective deficits in individuals with ASD affect the processing and expression of humour. This will help in the understanding of the components that contribute to humour in TD individuals (Samson, 2013). Asperger (1944) described individuals with Asperger's syndrome as humourless and not able to understand jokes. Humour in ASD is becoming increasingly better understood (Samson, 2013). Clinicians could consider the humour styles of children with ASD and work to support their use of humour as a tool to establish friendships and relationships. 7 funding, 8 conflicts of interest and the relevant statements.

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Abstract. Scotland and Malta share a high prevalence of overweight and obesity: around two-thirds of adults are overweight (including obese), and one-third are obese. Reducing this burden of overweight and obesity is a priority for both Scottish and Maltese Governments, which involves setting dietary goals and monitoring the progress of the population to meeting those goals, and developing policies to improve health. This commentary summarises the progress of Scotland and Malta to meeting dietary goals, challenges to meeting the goals, and actions being taken. Whilst dietary guidelines are in place in both countries, Malta has yet to estimate average population dietary intakes and is awaiting results from its first national survey. In Scotland, however, there are various well-established dietary surveys which can be used to inform the development of policy, yet little progress towards the Scottish Dietary Goals has been seen between 2001 and 2015, and the prevalence of overweight and obesity has not changed since 2008. In order for dietary goals to be met, dietary guidelines need to be promoted, understood, and translated into changes in dietary behaviour. However, barriers to behaviour change need to be addressed, with research required to design long-term interventions that are successful and cost-effective in all population groups. Scotland can learn from Malta’s dietary guidelines which treat fruit and vegetables as two separate groups, provide serving size and consumption guidelines, and incorporate the positive message to use herbs and spices for flavour. Also, Malta can learn from the methodologies of established Scottish and UK surveys to create its own programme of dietary surveys. The sharing of experiences of researchers, policy makers and health promoters in these countries is therefore beneficial for tackling the current obesity epidemic and promoting a healthier future.

Keywords: Diet, food, nutrient, goals, Malta, Scotland

1 Introduction

Scotland and Malta share a significant obesity problem. In Scotland, the prevalence of overweight (including obesity) and obesity was 65% and 29% respectively in adults aged >16 years in 2016 (Bardsley, 2017). In Malta, the prevalence of overweight was 70% in adults aged 18–70 years in 2014–16, and 37% of men and 31% of women were obese (Cuschieri et al., 2016). Reducing the disease burden from unhealthy diets are priorities for Scottish and Maltese Governments. This involves setting dietary goals and monitoring the progress of the population to meeting those goals, which informs policies to improve health and wellbeing. This commentary summarises the progress of Scotland and Malta to meeting dietary goals, challenges to meeting the goals, and actions being taken. We conclude with recommendations based on the examination of strategies in place in each country.

2 Scottish Dietary Goals and Guidelines

The Scottish Dietary Goals were introduced in 1996 (The Scottish Office, 1996) and were based on the UK Dietary Reference Values (Department of Health, UK, 1991) for selected nutrients and foods. They were originally intended for achievement in 2005, although the timescale was later extended to 2010. The goals were most recently updated in 2016 to “indicate the direction of travel, and the extent of the dietary change needed, to reduce the burden of obesity and diet-related disease in Scotland” and to “underpin diet and health policy in Scotland” (Scottish Government, 2016). The goals are similar to those set in 1996 regarding fruit and vegetables, oily fish, total fat, saturated fat, and salt. Goals

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were also added for red meat, calories, trans fatty acids, free sugars, dietary fibre and total carbohydrate. Most goals are monitored via secondary analysis of Scottish data from the Living Costs and Food Survey, which collects food purchase data from every person over seven years of age in each household for 14 days. Estimates of food waste are made before estimating consumption for a typical average household member (Barton et al., 2018). The National Diet and Nutrition Survey uses a four day estimated diary to monitor trans fatty acid intakes (Bates et al., 2017), and the urinary sodium survey monitors salt consumption (Scottish Centre for Social Research, 2011). The goal for calories is to achieve a healthy balanced diet (Public Health England, 2016). The Eatwell Guide divides food into five groups: (1) fruit and vegetables, (2) potatoes, bread, rice, pasta and other starchy carbohydrates, (3) dairy and alternatives, (4) beans, pulses, fish, eggs, meat and other proteins, and (5) oils and spreads. There are also recommendations regarding fluid intake, food label use, and reducing fat, salt and sugar (Table 2).

### Table 1: Average food and nutrient intakes in Scotland compared with the Scottish Dietary Goals (Scottish Government, 2016)

<table>
<thead>
<tr>
<th>Food / Nutrient</th>
<th>Goal</th>
<th>Average Intake</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy density</td>
<td>Average energy density of the diet to be lowered to 125 kcal/100g</td>
<td>178 kcal/100g</td>
<td>Barton et al., 2018</td>
</tr>
<tr>
<td>Fruit &amp; vegetables</td>
<td>Average intake to reach &gt;400 g/day</td>
<td>257 g/day</td>
<td>Barton et al., 2018</td>
</tr>
<tr>
<td>Oily fish</td>
<td>Increase to 1 portion per person per week (140 g/week)</td>
<td>34 g/week</td>
<td>Barton et al., 2018</td>
</tr>
<tr>
<td>Red &amp; processed meat</td>
<td>Average intake to be pegged at around 70 g per person per day</td>
<td>56 g/day</td>
<td>Barton et al., 2018</td>
</tr>
<tr>
<td>Total fat</td>
<td>Average intake to reduce to no more than 35% food energy</td>
<td>38.9% food energy</td>
<td>Barton et al., 2018</td>
</tr>
<tr>
<td>Saturated fat</td>
<td>Average intake to reduce to no more than 11% food energy</td>
<td>15.1% food energy</td>
<td>Barton et al., 2018</td>
</tr>
<tr>
<td>Trans fatty acids</td>
<td>Average intake to remain below 1% food energy</td>
<td>0.6–0.8% food energy</td>
<td>Bates et al., 2017</td>
</tr>
<tr>
<td>Free sugars</td>
<td>Average intake not to exceed 5% total energy</td>
<td>14.4% total energy</td>
<td>Barton et al., 2018</td>
</tr>
<tr>
<td>Salt</td>
<td>Average intake to reduce to 6 g/day</td>
<td>8.8 g/day</td>
<td>Scottish Centre for Social Research, 2011</td>
</tr>
<tr>
<td>Fibre</td>
<td>Increase in average consumption for adults (&gt;16 years) to 30 g/day</td>
<td>12 g/day²</td>
<td>Barton et al., 2018</td>
</tr>
<tr>
<td>Total carbohydrate</td>
<td>Average intake of approximately 50% total dietary energy</td>
<td>46.6% food energy</td>
<td>Barton et al., 2018</td>
</tr>
</tbody>
</table>

1Average intake of non-milk extrinsic sugars
2Average intake of non-starch polysaccharides (main component of dietary fibre)

Table 1 shows recent estimated Scottish average intakes compared with the Scottish Dietary Goals. Energy density, and intakes of total fat, saturated fat, salt and free sugars (as non-milk extrinsic sugars) are considerably higher than recommended, and consumption of fruit and vegetables, oily fish and dietary fibre (as non-starch polysaccharides) is lower than recommended. Therefore, the Scottish population require more support to improve their diet, through a combination of individual behavioural changes, reformulation by the food and drink industry, and changes to the obesogenic environment through a range of initiatives such as taxes on high fat/sugar products and policies to reduce easy accessibility to high fat/sugar foods and drinks.

### Table 2: Comparisons between the UK Eatwell Guide and Malta Healthy Plate

<table>
<thead>
<tr>
<th>Components</th>
<th>UK Eatwell Guide</th>
<th>Malta Healthy Plate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Within main illustration</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plate model</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Number of food groups</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Fat, sugar and salt reduction</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Hydration</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

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3 Maltese Dietary Guidelines and Nutrient Goals

Malta has long recognised the need for promoting a healthy balanced diet in response to changes in local eating behaviours and increased obesity prevalence through the years. The first nutrient goals for Maltese adults were presented in 1986 and included guidelines for 12 nutrients, with recommendations to ‘eat less meat and have fish and poultry in preference to beef; substitute high-fat dairy products with low-fat alternatives; and eat fewer eggs, more fresh fruit and vegetables and wholegrain products; and drink fewer soft drinks, more water and milk’ (World Health Organisation, 1986). The first Food Based Dietary Guidelines were then launched in 1990 (Department of Health, Malta, 1990) and focused on: reducing fat, sugar and salt; increasing fibre; reducing meat with an emphasis on white meat and fish; less high-fat dairy and eggs; more fruit and vegetables and wholegrain products; and reducing alcohol consumption. In 2004, the guidelines were revised to represent a Malta Food Pyramid Guide, which recommended the highest daily consumption from the starchy foods group at the bottom of the pyramid, followed by fruit and vegetables, fewer daily servings of meat and alternatives and dairy products, and with the fats and oils group depicted at the top of the pyramid.

The adult dietary guidelines were last updated in 2015 (Health Promotion and Disease Prevention Directorate Malta, 2015, 2016) and considered recommendations from the 2015–20 ‘Food and Nutrition Policy and Action Plan for Malta’ (Health Promotion and Disease Prevention Directorate Malta, 2014). This latest guide, for adults aged 19–65 years, presents ‘The Healthy Plate’ versus the pyramid image, and depicts six food groups: (1) cereals and cereal products, (2) vegetables, (3) fruit, (4) milk and milk products, (5) lean meat, fish, poultry, eggs, legumes, nuts and seeds, and (6) fats and oils. It includes a focus on the Mediterranean diet, serving sizes for all food groups, and the healthy lifestyle messages below (Table 2).

- A focus on variety from the different food groups
- Using herbs and spices for flavouring, without use of added salt
- Drinking plenty of water
- The importance of keeping active
- Limiting intake of saturated and trans fats, sugar and salt, and consumption of alcohol and energy drinks
- Good oral health
- Food safety tips

It is intended to revise these guidelines once results are available from the first Maltese dietary survey – conducted in 2015–16 using standardised electronic software (GloboDiet) and 24-hour dietary recalls. However, it is expected that the population will not meet the dietary guidelines. The high prevalence of obesity, and data from general food consumption surveys like the Malta Food Consumption Survey (which used a 5-day food diary), suggest that sweets, biscuits and confectionery remain the most popular snacks, with a low intake of fresh fruit at 1.25 servings/day (Malta Standards Authority, 2010). Similarly the 2014–15 European Health Interview Survey (which used two lifestyle questionnaires) reported that 58% of Maltese adults consume fruit each day, with only 40% consuming vegetables daily (Gauci et al., 2018).

4 Barriers and solutions to healthier diets

In order for dietary goals to be met, dietary guidelines need to be promoted, understood, and translated into changes in dietary behaviour. However, barriers to behaviour change need to be addressed before the gap between guidelines and practice can be closed. We discuss two examples below:

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reducing the prevalence of overweight and obesity, and increasing the consumption of fruit and vegetables.

4.1 Overweight and obesity

Individual, social and cultural, and environmental factors all contribute to weight gain. In a workshop conducted in July 2018 at the University of Malta, stakeholders discussed their opinions on what constituted the main barriers to weight loss. These were numerous and diverse and included time issues, the (higher) cost of healthy food, and taste (individual level), lack of support, cultural barriers and stigma (social and cultural level), and the obesogenic environment, i.e. easy availability of unhealthy food, lack of open spaces (for physical activity) and marketing of unhealthy products (environmental level) (Masson & Copperstone, 2018).

In British adults, the most common perceived cause of obesity was the food environment: 'people are overweight because there are so many unhealthy foods around' (61%) (Beeken & Wardle, 2013). Individuals were most supportive of policies involving healthy lifestyle campaigns (71%) and food labelling in restaurants and takeaways (66%), and least supportive of taxes on the sale of unhealthy foods (32%). However, in 2018, the UK Government introduced the Soft Drinks Industry Levy (the ‘Sugar Tax’) which requires soft drink companies to pay a fee if drinks contain too much added sugar. Since the policy was announced in 2016, over 50% of manufacturers have reformulated their drinks to contain less sugar (HM Treasury, 2018).

Also in 2018, the Scottish Government published its ‘Diet and Healthy Weight Delivery Plan’ which aims to achieve its vision for Scotland ‘where everyone eats well and has a healthy weight’ by working on five outcomes: (1) children have the best start in life – they eat well and have a healthy weight, (2) the food environment supports healthier choices, (3) people have access to effective weight management services, (4) leaders across all sectors promote healthy diet and weight, and (5) diet-related health inequalities are reduced. However, the Scottish Government’s Obesity Route Map (2010) and Action Plan (2011) had little success: the prevalence of overweight and obesity is unchanged since 2008 (Bardsley, 2017). Nevertheless, a review of the Action Plan concluded that the situation may have been worse without the considerable effort in response to the Obesity Route Map (Kerr, 2015).

The Maltese ‘Healthy Weight for Life Strategy’ (2012–20) outlines initiatives relating to the promotion of healthy eating and physical activity and the provision of healthcare services including weight management programmes. Policies to tackle overweight and obesity in Malta include ‘A Strategy for the Prevention and Control of Non-Communicable Diseases in Malta’ and ‘A Healthy Weight for Life Strategy’ (Ministry for Health, the Elderly and Community Care, Malta, 2010, 2012), and various initiatives to promote healthy lifestyle, as outlined by the Malta Food and Nutrition Policy Action Plan (Health Promotion and Disease Prevention Directorate Malta, 2014), include increasing physical activity, eating more fruit and vegetables, promotion of the Mediterranean diet, and reading of food labels.

4.2 Fruit and vegetables

The main barriers to increasing fruit and vegetable consumption have been reported to be ‘cost’ for fruit, but ‘food preferences’ and ‘taste’ for vegetables (Glasson et al., 2010). Stakeholders in Malta also identified taste, cost, lack of cooking skills and poor budgeting as individual barriers; stigma and peer pressure as social barriers; and poor marketing (more unhealthy food being advertised) as well as fear of high levels of pesticide residues as environmental barriers to consuming more fruit and vegetables (personal communication, 2018). A Maltese study with stakeholders including farmers and consumers revealed that prices and time to prepare healthy food were the main barriers for healthy, lean and fair food (The President’s Foundation for the Wellbeing of Society, 2018).

The different determinants of consumption of fruit and vegetables, and their differing potential health benefits, support their treatment as two separate groups in health promotion strategies – as in the Malta Healthy Plate, but not the UK Eatwell Guide. In Scotland, the lack of improvement in fruit and vegetable consumption since 2001, and the lower consumption of both fruit and vegetables in more deprived areas (Barton et al., 2018), justifies the need for considerable work to develop long-term interventions that are successful and cost-effective in all population groups.

5 Recommendations

Scotland and Malta require food and drink policies that are effective in order to treat and further prevent overweight and obesity. Policies need to create an enabling environment for all sectors of the population, with priorities being children who need to learn healthy food preferences, and groups in more deprived areas who need to overcome barriers to express healthy preferences. We can benefit by learning about strategies in other countries which share similar challenges, and exploring opportunities for translating these practices into effective policies at home. For instance, Scotland can learn from Malta’s dietary guidelines which treat fruit and vegetables as two separate groups, provide serving size and consumption guidelines, and incorporate the positive message to use herbs and spices for flavour. Also, Malta can learn from the methodologies of established Scottish and UK surveys to create its own programme of dietary surveys. The sharing of experiences of researchers, policy makers and health promoters in these countries is therefore beneficial for tackling the current obesity epidemic and promoting a healthier future.

6 Funding

None

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7 Conflicts of interest

The authors report no conflicts of interest.

References


Ministry for Health, the Elderly and Community Care (2010) A Strategy for the Prevention and Control of Non-Communicable Disease in Malta


