For Submission to OMEGA Journal of Death and Dying

Title: Can exposure to online conversations about death and dying influence death competence? An exploratory study within an Australian Massive Open Online Course.

Authors

Lauren Miller-Lewis. B.Psych (Hons), PhD. (Corresponding Author)
Palliative and Supportive Services, Flinders University, GPO Box 2100, Adelaide SA 5001
Australia lauren.miller@flinders.edu.au Ph. +61 8 72218239

Jennifer Tieman. B.Sc (Hons), MBA, PhD.
Palliative and Supportive Services, Flinders University, GPO Box 2100, Adelaide SA 5001
Australia jennifer.tieman@flinders.edu.au

Deb Rawlings. RN. BSc (Hons), GradCertEducation (Higher Ed), MPH.
Palliative and Supportive Services, Flinders University, GPO Box 2100, Adelaide SA 5001
Australia deborah.rawlings@flinders.edu.au

Deborah Parker. RN, BA, GradCertLeadership, MSocSc, PhD.
Faculty of Health, University of Technology Sydney, Level 7, 235 Jones St, Ultimo NSW 2007
Australia deborah.parker@uts.edu.au

Christine Sanderson. BA, BMBS, MPH, FRACP.
Palliative and Supportive Services, Flinders University, GPO Box 2100, Adelaide SA 5001 Australia
Faculty of Health, University of Technology Sydney, Level 7, 235 Jones St, Ultimo NSW 2007 Australia
Staff Specialist, Palliative Medicine, Calvary Health Care Kogarah
christinersanderson@gmail.com

Acknowledgements

CareSearch is funded by the Australian Government Department of Health. We would like to thank the many people who contributed their time and expertise to the project, including members of the National Advisory Group and the Knowledge Network Management Group. We would also like to thank OpenLearning and The Groundswell Project for their contributions.

Conflict of interest

JT, DR and LM-L are employed by the CareSearch Project which receives grant funding from the Australian Government Department of Health. CS has been previously employed by the CareSearch Project. The funding sponsors had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, and in the decision to publish the results. DP has no competing interests.

Keywords

attitude to death; community education; online learning; prospective

Can exposure to online conversations about death and dying influence death competence? An exploratory study within an Australian Massive Open Online Course.

Abstract

A Massive Open Online Course (MOOC), Dying2Learn, was designed to foster community death conversations and strengthen community awareness of palliative care and death as a normal process. This exploratory study used a pre-post prospective design to determine if participation in Dying2Learn and exposure to online conversations about death and dying resulted in any significant influence on death competence in 134 participants who completed the Coping-with-Death-Scale both at the beginning and end of the course in 2016. Death competence refers to a range of attitudes and capabilities people have for dealing with death. Results at the end of the course indicated that engagement in Dying2Learn led to significant improvements in death competence scores over time (medium-to-large effect size). The positive impact was greater for those who completed more of the course, and effectiveness did not depend on socio-demographic characteristics. In conclusion, this study found that an online learning platform in the form of a MOOC could engage community members in meaningful social discussion about death and dying, and that exposure to these conversations was beneficial for all participants regardless of previous exposure to death. Further exploration is required to determine whether this change in death competence will have an impact on participant's behaviour in the community regarding death conversations and preparedness.

Introduction

Contemporary western societies have become death-denying. This view is supported by literature spanning several decades (Aries, 1974; Fonseca & Testoni, 2012; Kubler-Ross, 1969; Robbins, 1991). Over time the concept of death appears to have become excluded from social life, with individuals and communities uncomfortable discussing death and considered off-limits for many (Corr, 2016; Gellie, Mills, Levinson, Stephenson, & Flynn, 2015). This has grown in tandem with medical advances that attempt to prolong life, which for many means postponing death. In many societies such as Australia, dealing with death and dying has been outsourced from the family home to sit more commonly with professionals in hospital settings (Fonseca & Testoni, 2012; Gellie et al., 2015; Kubler-Ross, 1969; Swerissen & Duckett, 2015). The institutionalisation and depersonalisation of death has reduced community familiarity with death, leading to difficulties in how society emotionally copes with, accepts, and prepares for death (Fonseca & Testoni, 2012; Gellie et al., 2015; Balk, 2007). Recent calls for death education in the general community (Fonseca & Testoni, 2012; Wass, 2004), suggest interest in a broader public health approach (Kellehear, 2015), which may be of greater importance given anticipated increases in death rates corresponding with ageing populations, and its potential impacts on families, workplaces and communities (Doka, 2015; Productivity Commission, 2013).

Building community engagement with conversations about death and dying could encourage active involvement in decision making, making end-of-life wishes known, and acceptance of death as an inevitable part of the life cycle (Chapple et al., 2017; Swerissen & Duckett, 2015; URBIS, 2016). Governments in many countries such as the UK and Australia actively support palliative care and advance care planning as well as death awareness initiatives such as death cafes and compassionate communities to improve community appreciation of dying and death as a normal part of the life continuum (Abel & Kellehear, 2016; Clark et al., 2017; Kellehear, 2016; Pizzo, 2016; URBIS, 2016). By being able to discuss death and dying in our families, communities and with our health care providers, it is presumed we can develop the skills and competence to enable our own decision-making and support for others in our family and community (Noonan, Horsfall, Leonard, & Rosenberg, 2016). Thus far, there has been limited research on the impact of these public health approaches to palliative care (Noonan et al., 2016).

Measuring the impact of strategies to improve death awareness and death coping has challenges. Much of the literature on death has focussed on death anxiety and fear of death, and only relatively recently has the focus broadened to consider death coping and competence (Robbins, 1994; Neimeyer, Moser, & Wittkowski, 2003; Wass, 2004). Robbins (1994) defines death competence as a construct representing a range of capabilities and skills people have for dealing with death (of the self and others), as well as our attitudes and beliefs about these abilities. Death competence includes behavioural, cognitive, and affective components (e.g., being able to talk about death, knowledge of death arrangements, feel prepared to face death) (Neimeyer et al., 2003; Robbins, 1994). Investigating death attitudes from a skills-orientated perspective of death competence rather than death anxiety is theorized to be more valuable for evaluating the results of death education efforts than an anxiety focus, and has been found to be better at predicting death-related preparatory behaviours (Robbins, 1991; Robbins, 1994; Wass, 2004). It offers a strength-based approach to monitoring potential gains from a death education experience, and can be useful not only for health care professionals, but for understanding death competence in the general community too (Bugen, 1981; Robbins, 1994; Wass, 2004).

Indeed, previous research systematically measuring death competence has demonstrated that face-to-face death-related education and training programs can result in improvements in recipients' death competence and coping. For example, gains in death competence have been found in samples of hospice volunteers (Claxton-Oldfield, Crain, & Claxton-Oldfield, 2007; Finn Paradis & Usui, 1987; Wilkinson & Wilkinson, 1987), nurses and health workers (Brysiewicz & McInerney, 2004), and university students (Bugen, 1981; Schmidt-RioValle et al., 2012). Research has also indicated that the level of death competence may vary based on age, and experience with death and bereavement (e.g., Robbins, 1994). However, to our knowledge, no studies examining the impact of death education on death competence in the general community exist.

Online learning is a burgeoning educational strategy and the recent arrival of Massive Open Online Courses (MOOCs) offers technologically advanced capabilities for educational interaction (Hughes, Preston, & Payne, 2016). MOOCs are short online courses often made freely available to the public. In particular, MOOCs following a connectivist pedagogical model (cMOOCs) focus on facilitating socially-constructed learning, collaboration and exchange by utilising the digital environment to create active group fora, synchronous discussions and debates, and peer collaboration and support (Hughes et al., 2016; Kennedy, 2014). Such an online platform may hold great potential as an avenue to engage the general community in open discussion about death and dying. Although it is expected that death education can be effectively implemented as fully online courses (Sofka, Cupit & Gilbert, 2012), given the success of end-of-life care courses delivered partially online for health professionals and students (e.g., Hughes et al., 2016; Loerzel & Conner, 2016; Pereira et al., 2008; Reed et al., 2017), the potential role of online environments in facilitating death conversations, awareness, and competence through educational courses for the community has not yet been explored.

The Present Study

Given the presence of a society where death can be seen as something denied, avoided and feared (Corr, 2016; Fonseca & Testoni, 2012), and the gap in knowledge on the effect of online learning on death competence in the community, a MOOC called Dying2Learn was developed. A team with clinical and academic expertise in palliative and associated disciplines as well as online learning from CareSearch (www.caresearch.com.au) at Flinders University in South Australia, designed Dying2Learn. The MOOC was made available to the general public worldwide and aimed to provide a community platform for social discussion and connection regarding death, dying, and palliative care. The objective of the Dying2Learn MOOC was to provide learning opportunities in a supportive environment that could foster community conversations and strengthen community awareness of palliative care and death as a normal process. We speculated whether these conversations could in-turn potentially lead to an increase in participants' knowledge, skills, and competencies in coping with death in their personal, professional and wider social lives. The MOOC had an experiential focus on personal engagement in death as previous death education research indicates that humanistic experiential programs tend to be more effective than didactic programs (Durlak & Reisenberg, 1991; Maglio & Robinson, 1994; Noonan et al., 2016; Wass, 2004). Activating community support, stimulating interpersonal conversations and personal reflection are considered crucial for effective death education programs (Fonseca & Testoni, 2012; Noonan et al., 2016; Wass, 2004). Dying2Learn commenced in June 2016, and was run intensively over six-weeks (rather than continuously enrolling) so that participants would be active in the course at the same time, therefore fostering opportunities to develop personalised connections and rapport with each other. This was considered vital for facilitating personalised interaction and sharing that was essential in the topic content and activities (Wass, 2004). The course facilitators monitored online discussions frequently to ensure a safe online environment for participants to discuss sensitive death-related topics (Sofka et al., 2012). The content of the course is described further in the next section.

Complementing the general evaluation of the Dying2Learn MOOC (involving project-devised questions related to the course learning objectives and general satisfaction), a formal research study investigating death competencies using standardised questionnaire tools was undertaken, with all enrolees eligible to participate. This builds upon existing research considered limited by failure to use standardised assessment tools for measuring change over time in death-related learning outcomes (Gillan, van der Reit, & Jeong, 2014; Pulsford, Jackson, O'Brien, Yates, & Duxbury, 2011).

The purpose of this exploratory study was to understand whether engagement in online MOOC learning and discussions about death and dying had any impact on participants' feelings of death competence, and whether this varied depending on age and experience with health care and bereavement. We sought to answer the following research question: "In members of the general community who enrolled in a MOOC on death and dying, was there any significant change over time in death competence between enrolment and the end of the MOOC?"

Method

Research Setting and Participants

The study methodology is described in accordance with the STROBE statement (Vandenbroucke et al., 2007). The Dying2Learn MOOC was developed in Australia and opened for enrolment in June 2016 on the OpenLearning online platform (www.openlearning.com). The MOOC was freely available on the online platform to anyone in the general public who wanted to participate, the majority of whom resided in Australia. But as the course was available online worldwide, participants accessed it from countries other than Australia, predominantly the United Kingdom, United States, New Zealand, and Canada. MOOC enrolees were eligible to participate in this pre-post prospective study. A flow chart of participant eligibility and participation in each phase of the research study is shown in Figure 1. Of the 1069 MOOC enrolees invited to participate in the optional research study, 312 agreed to participate in the research study and 277 of these provided valid responses to the key baseline scales. This represented an initial response rate of 25.9%. Based on enrolment records, participants recruited for the research study were no different from other MOOC enrolees on gender, occupation, education, Australian residence or regional area disadvantage. However, MOOC research study participants were significantly older ($t[df=1146]= -5.42$, $p<.0005$) than those who chose not to participate ($m=53$ vs. $m=48$ years). Those who participated in the research study also completed more of the MOOC ($m=45.92$ [$SD=31.86$] vs. $m=23.61$ [$SD=29.33$], $t[df=433.4]= -10.35$, $p<.0005$), and made more comments in the MOOC (*m*=15.88 [*SD*=25.12] vs. *m*=5.80 [*SD*=10.17], *t*[*df*=305]= -6.51, *p*<.0005). Table 1 provides demographic information about the 277 research study participants. Of these baseline research participants, *n*=254 (91.7%) commenced the Dying2Learn course by accessing content and/or completing activities. After the MOOC finished, *n*=134 participants provided key outcome data in the post-MOOC research survey (retention rates of 48.4% of those who provided baseline data, and 52.8% of the baseline research participants who commenced MOOC participation). These participants had matched data from both the baseline and post-MOOC surveys on death competence, allowing a pre-post assessment of change. Therefore, analyses were conducted based on complete-case analysis using the 134 participants with full data (See Table 1 and Results).

Insert Figure 1 and Table 1 here

Procedure

Upon enrolment, MOOC participants completed a short set of questions regarding their socio-demographic background, and questions related to course learning objectives. After this, enrolees could access informal introductory content prior to commencing four weeks of topic-based learning resources and activities, and then ending with a final reflections week. Data was exported from the OpenLearning platform for analysis once the MOOC ended, including the number of participants enrolled in the MOOC and indicators of MOOC engagement.

A formal research study embedded in the MOOC investigated life and death attitudes and death competence. MOOC enrolees were invited to participate in this optional research study, which is the focus of this paper. Death competence was assessed at the beginning and end of the course using validated questionnaires administered through an online survey. MOOC enrolees were sent an email invitation to participate in the research study before the commencement of MOOC topic-based learning modules. The invitation included a unique weblink to the online survey (CareSearch, 2017), which had 60 questions and took an estimated 10-15 minutes to complete. A reminder email was sent to non-respondents two days after the initial invitation. The online survey was active for 24 days during enrolment and course-commencement period. A small number of MOOC enrolees joined the course after module 1 commenced; these enrolees were emailed the research study invitation within 48 hours of enrolment, to minimise their exposure to course content prior to completing the baseline survey. Those who enrolled more than 10 days after module 1 commenced were not invited to participate in the research study given their opportunity for exposure to a greater amount of course content before completing the baseline research survey.

The day after the MOOC concluded, all research study participants who accessed the baseline research survey were sent an email requesting they complete the post-MOOC research survey using the unique online survey weblink provided. A reminder email was sent to non-respondents two days after the initial email, and a final reminder was emailed one week later. A unique ID code was assigned to each participant for data-matching purposes. Once data was matched from the multiple sources, it was de-identified prior to analysis. This methodology was approved by Flinders University Social and Behavioural Research Ethics Committee (Project 7247).

Given our interest in the effect of course engagement on death competence, enrolees who didn’t engage with the course were excluded. Complete cases with matched data from both the baseline and post-MOOC research surveys on death competence were the focus sample for the present study, which allowed a pre-post assessment of change in death competence over the period of time they were enrolled in the MOOC.

Course Content

The Dying2Learn MOOC explored social issues around death and dying by looking at how concepts of death and care practices have changed over time, the role of medicine in how we die, representations of dying and death in the media, and how we engage with language and humour around death. The MOOC content was delivered over six weeks, and included an introduction module, four core topic modules, and a final module encompassing reflection activities and a course evaluation. Module 1 covered how society engages with death through humour, language, public mourning and funerals. Module 2 looked at representations of death in the media, including art, film, and television. Module 3 considered if death is the problem, is medicine the answer. Module 4 examined the growing influence of the internet and discussed digital legacies. Participants engaged in MOOC learning activities by accessing content (videos, articles), and completing activities by posting comments reflecting on their learning or responding to topic reflection questions. For example, one activity asked participants to report on euphemistic alternatives people use instead of the word ‘death’ or ‘dead’ (Rawlings, Tieman, Sanderson, Parker, & Miller-Lewis, 2017). They could also contribute to discussion boards and real-time online chats, create special interest groups, and share resources. The time commitment to complete the course was approximately 15 hours. The content was developed by a team with knowledge and expertise in palliative care, associated disciplines, and online learning. The course facilitators’ approach to learning was collaborative, co-constructive, and exploratory rather than didactic. Facilitators helped guide participants when required, but participants were viewed as active co-contributors rather than passive recipients of learning. Further details are provided elsewhere regarding the course content (Rawlings, Tieman, et al., 2017), development and pedagogical approach (Rawlings, Miller-Lewis et al., 2017), and evaluation (Tieman, Miller-Lewis, Rawlings, Parker, & Sanderson, 2018).

Measures

Socio-Demographic information was collected through five questions asked at enrolment, and seven questions asked in the baseline research survey. Participants reported their age in years, and gender identity (male; female; Trans; other; prefer not to disclose). Participants were asked to identify their occupation as either ‘health professional’ or ‘not a health professional’. Participants reported their highest level of completed education (some high school; completed high school; trade school/equivalent; university studies) adapted from the Australian Bureau of Statistics (ABS) 2016 Census (ABS, 2015a). Education was also dichotomized to compare those with university qualifications to those without university qualifications. Participants’ Australian residential postcode was recorded if they lived in Australia, or the name of their residing country if not living in Australia. For Australian participants, the 2011 Census Socio-Economic Index for Areas (SEIFA) Index of Relative Socio-Economic Disadvantage (IRSD) corresponding to their postcode was assigned (ABS, 2013). This index ranks Australian postal areas according to relative disadvantage, by summarizing information about economic and social conditions of people and households within each area. Scores based on the 2011 Census range from 506.3-1155.5, with low scores indicating greater area disadvantage (i.e., many households with unemployment, low income, no qualifications, low skilled occupations). Higher scores on the SEIFA Disadvantage index indicate a relative lack of area disadvantage (i.e., few households with unemployment, low incomes, no qualifications, low skilled occupations) (ABS, 2013).

In the baseline research survey, participants were asked to report what country they were born in, and which culture they identify with the most. For this study, responses to these questions were dichotomized to indicate whether the participant was born in Australia, and whether they identified with Australian culture. We asked participants the extent to which they consider themselves to be ‘a religious person’ or ‘a spiritual person’. This was measured with two questions from the Fetzer Brief Multidimensional Measure of Religiousness and Spirituality for use in health research (John E Fetzer Institute, 2003) which were responded to on a 4-point Likert scale from “not at all” to “very”, with higher scores indicating greater perception of oneself as religious and spiritual, respectively. These validated questions have been frequently used in health and palliative care research (Alcorn et al., 2010; Donohue, Boss, Aucott, Keene, & Teague, 2010; John E Fetzer Institute, 2003). As indicators of death and caring experiences, the baseline survey also included "has someone close to you died in the last five years?", and "have you cared for, or are you caring for someone who has a terminal illness?" Participants could respond to these two questions with 'yes, 'no' or 'not sure'. Finally, research study participants were asked at baseline to report their self-assessed health status, using the ABS National Health Survey question: "In general, would you say your health is: excellent; very good; good; fair; or poor" (ABS, 2015b). This measure is widely used to indicate overall health (ABS, 2015b).

Death Competence was measured with Bugen's Coping with Death Scale (Bugen, 1981; Robbins, 1991, 1994), which is designed to measure the construct of death competence through representations of human skills and capabilities in dealing with death (Robbins, 1994). The Coping with Death scale was devised to measure gains resulting from death education for volunteers, with the intention of emphasising coping skills as a desirable outcome of death education (Bugen, 1981; Robbins, 1991; 1994). The self-report questionnaire comprises 30 statements about aspects of coping with death, including items related to one's self ("I can talk about my death with family and friends"), and items related to others ("I can communicate with the dying"). Respondents report their level of agreement with each statement using a 7-point Likert scale ranging from 1 "do not agree at all" through to 7 "agree completely". The total death competence score is derived by summing items after reverse-scoring item 13 and 24. The final score has a potential range of 30 to 210, with higher scores indicating greater death competence. The Coping with Death Scale has evidence of construct validity in distinguishing hospice volunteers from others, the expected negative associations with scales measuring death anxiety and fear of dying, and the ability to predict death preparation behaviours. It has also demonstrated strong internal consistency, but the factor structure of the English version of the scale has not been examined (Bugen, 1981; Camarneiro & Gomes, 2015; Neimeyer et al., 2003; Robbins, 1991, 1994). In our sample, Bugen's scale showed high internal consistency (Cronbach's Alpha's of .94 and .93 at baseline and post-MOOC respectively).

MOOC Engagement metrics were generated by the OpenLearning MOOC platform, and were extracted after the MOOC closed. The total percentage of course progress measured the level of engagement for each participant based on the overall proportion of activities completed and content pages accessed. A count of the number of comments made by each participant in the MOOC was also extracted.

Statistical Approach

This study analyses data provided by MOOC enrolees who participated in the research study at both baseline (pre-MOOC commencement) and follow-up (post-MOOC completion). MOOC enrolment and MOOC engagement data provided within the course was also utilised. Given the exploratory nature of the study, and the adequate sample size at both time points, missing data was not imputed to increase statistical power. Instead a complete case approach was used for the main analyses. A statistical significance level of $p<.05$ was used, and effect sizes were interpreted based on standard recommendations (Cohen, 1988). SPSS was used for data analyses.

Descriptive statistics (means and standard deviations, or proportions) were produced for each variable. Tests for normality and investigation of histograms revealed scores on the death competence scales at both time points were negatively skewed but did not deviate significantly from normality (*K-S test* of normality statistic =.069 and .089 respectively, $p>.01$; see Pallant, 2010). The study variables overall did not show substantial deviation from normality based on skewness, kurtosis, or histogram examination. (One exception was a relatively high level of kurtosis in the number of MOOC comments made, which peaked at the lower range of scores, which is typical of count variables). Bivariate analyses (Pearson's *r* correlations and Independent samples *t* tests) were conducted to determine bivariate (unadjusted) associations between socio-demographic factors, MOOC engagement, and scores on death competence. This informed the choice of variables to examine in relation to predicting change over time in death competence (Pallant, 2010).

Longitudinal analyses examining pre-to-post changes in death competence over the course of the MOOC were conducted in the first instance using repeated-measures Analysis of Variance (ANOVA), with the within-subjects factor of time (measured pre-MOOC and post-MOOC) as the explanatory/independent variable, and level of death competence based on Bugen's Coping with Death Scale as the outcome/dependent variable. Subsequent analyses included consideration of health professional status and bereavement experiences as moderators of the effect of the MOOC on death competence, to see if the effect of the MOOC on death competence depended upon being a health professional or bereavement experience. This was examined using a mixed model between-within ANOVA, with health professional status and bereavement experience treated as between-groups independent variables, time as a within-groups independent variable, and death competence as the dependent variable. Age (centred on the mean, as recommended by Van Breukelen & Van Dijk, 2007) was treated as a covariate in these analyses. Hierarchical Multiple Linear Regression was used to identify demographic variables predictive of post-MOOC death competence after adjusting for pre-MOOC death competence, which is indicative of change in death competence scores over time (i.e., demographic factors that predict the degree to which the scores improved). Including the level of MOOC engagement as a predictor in this model enabled the examination of whether greater engagement in the MOOC led to greater change in death competence over time.

Results

Participants and Descriptive Statistics

Table 1 provides demographic information about the 134 participants, from the MOOC enrolment and baseline survey. The mean age of the sample was 54 (*SD*=12.1), and ranged from 22 to 76 years. Most (94%) were female, and 90% lived in Australia. Over half identified themselves a health professionals (53.7%), and 76.9% had a university qualification. Participants were more likely to identify themselves as being spiritual rather than religious, and 64.9% considered themselves to be in very good or excellent health. Two-thirds had experienced the death of someone close to them in the past 5 years, and two-thirds had experienced caring for someone with a terminal illness. The average percentage of course completion of the sample was 65.8% (*SD*=23.75), and they made an average of 25 comments (*SD*=32.36) during the MOOC.

Baseline scores on Bugen's death competence scale had a mean of 158.23 (*SD*=26.51). After the MOOC finished, death competence scores increased to a mean of 165.85 (*SD*=21.99). Baseline scores were higher than what has been previously found in non-patient-care volunteer groups (*m*=151.51) and palliative care volunteers prior to training (*m*=143.5) (Claxton-Oldfield et al., 2007; Robbins, 1994), and closer to means found in hospice volunteers in the midst of training (*m*=154.77) (Robbins, 1994).

Compared to complete-cases, research participants lost from the sample between the pre-MOOC and post-MOOC assessments (total *n*=143 based on *n*=23 who didn't commence MOOC and *n*=120 who didn't complete the death competence scale post-MOOC) were significantly (i.e., *p*<.05) more likely to self-identify as a health professional, have slightly lower educational attainment, make less progress towards MOOC completion and less comments in the MOOC (see Table 1). No differences were found on any other socio-demographic variables listed in Table 1. Participants lost to attrition had somewhat lower scores on death competence at baseline than the complete-cases (*m*=152.0 [*SD*=27.9] vs. *m*=158.2 [*SD*=26.5]), but this difference did not reach statistical significance, *t*(*df*=275)= -1.89, *p*=.060.

Bivariate Analyses

Table 2 reports bivariate relationships between socio-demographic variables and the scores on death competence at baseline and post-MOOC. There was no significant relationship with death competence scores for gender, location, birthplace, culture, SEIFA disadvantage, education level or self-assessed health. Unexpectedly, there was no statistically significant difference between health professionals and others on death competence scores pre-MOOC or post-MOOC (pre-MOOC *m*=156.07 vs. *m*=160.74, and post-MOOC *m*=164.86 vs. *m*=166.99, respectively). Age held a strong significant positive association with death competence scores pre-MOOC and post-MOOC, with older participants reporting greater death competence. Greater spirituality was significantly positively associated with greater death competence at both time-points, but greater religiosity only held a significant positive association with death competence scores at baseline, before the MOOC was underway. Death competence scores were statistically significantly different between participants with death experience and those without death experience. Participants with bereavement experience in the past 5 years had higher death competence scores than the non-bereaved at pre-MOOC (*m*=163.80 [*SD*=22.89] vs. *m*=146.44 [*SD*=29.90]) and Post-MOOC (*m*=169.40 [*SD*=18.81] vs. *m*=158.33 [*SD*=26.24]), respectively. The findings were similar for carer experience, with participants who had experienced caring for someone with a terminal illness reporting higher death competence scores than non-carers pre-MOOC (*m*=162.73 [*SD*=25.25] vs. *m*=150.44 [*SD*=25.54]) and post-MOOC (*m*=169.34 [*SD*=20.72] vs. *m*=159.13 [*SD*=23.08]), respectively. A cross-tabulation of carer experience and death experience revealed a significant overlap between these two variables, with 75.8% of those who experienced bereavement also reporting having cared for someone with a terminal illness; $\chi 2$ (*df*=1, *n*=133)=8.76, *p*=.003. Given this overlap could lead to multicollinearity, subsequent analyses including multiple predictors only included death experience, which had complete data available (*n*=134).

Insert Table 2 here

Bivariate correlations between MOOC engagement and death competence scores are also shown in Table 2. The percentage of course progress was not associated with baseline death competence scores, but was significantly positively associated with post-MOOC scores on death competence, with greater course progress associated with higher death competence scores at the end of the MOOC. We found no significant bivariate association between the total number of comments made in the MOOC and death competence scores at baseline or post-MOOC (see the bottom of Table 2).

A one-way repeated-measures ANOVA was conducted to compare scores on death competence at baseline and post-MOOC. Mean scores on death competence increased by 7.62 points between the beginning and the end of the MOOC (baseline *M*=158.23, *SD*=26.51, *95%CI*=153.7-162.8; post MOOC *M*=165.85, *SD*=22.00, *95%CI*=162.1-169.6). There was a statistically significant effect for time, *Wilks' Lambda*=.88, *F*(1,133)=18.89, *p*<.0005. Scores on death competence increased significantly over time, with a multivariate *Partial Eta*^{2}=.124, indicating a medium to large effect size of practical significance.

Multivariable Analyses

Multivariable analyses were used to determine if improvement in death competence over time differed depending on participant demographic characteristics. Table 3 presents the results of two mixed-model ANOVAs comparing changes in death competence scores from baseline to post-MOOC (repeated-measures factor) by between-subjects subgroups based on health professional occupation status and death experience. These analyses assess the impact of death experience (experience vs. no experience) and occupation (health professional vs. other occupation) on participants scores on death competence across the two time periods (baseline and post-MOOC). Given the significant association of age to death competence, age was mean-centred and added as a covariate in these analyses to adjust for its effects (Medical Research Council Cognition and Brain Science Unit, 2013; Van Breukelen & Van Dijk, 2007). In the model including the between-subjects factor of occupation, there was no significant interaction between occupation and time. The effect of the MOOC on death competence did not depend on the participant's health professional status. In the model including the between-subjects factor of death experience, there was no significant interaction between death experience and time. The effect of the MOOC on death competence did not depend on participant's experience of someone close dying. In considering main effects, the between-subjects main effect comparing the two occupation groups was not significant, indicating no difference in MOOC effectiveness for health professionals and other occupations. The between-subjects main effect comparing the two death experience groups was statistically significant. Participants who had death experience scored higher on death competence than those without death experience. This was a moderately sized effect (*Partial Eta*^{2}=.089). In both models, there was a statistically significant repeated-measures effect for time. The *Partial Eta*^{2} values of .127 for the model with occupation and, .140 for the model with death experience, both indicated a moderate to large effect size. Thus, after adjusting for age, all groups showed an increase in death competence across the two time-periods that was of a magnitude indicating practical significance.

Insert Table 3 here

Table 4 shows the results of an exploratory hierarchical linear regression predicting scores on death competence after the completion of the MOOC. By adjusting for scores on death competence at baseline, this gives the opportunity to examine the socio-demographic predictors of change over time in death competence pre-post MOOC. This helps answer questions regarding the extent to which any changes in death competence could potentially be attributed to engagement in the MOOC, over and above socio-demographic factors. It also provides an indicator of whether specific demographic groups were more or less likely to change in death competence as a result of participating in the MOOC. In the initial model, socio-demographic and MOOC engagement variables were entered as predictors, and accounted for 23.1% of the variance in post-MOOC death competence scores. MOOC participants who made more progress towards completion of the MOOC had significantly higher death competence scores at the end of the MOOC. Participants who had death experience also had significantly higher death competence scores post-MOOC. Participants who had poorer self-rated health had lower post-MOOC scores on death competence. This relationship was not found in bivariate analysis, suggesting this multivariable analysis finding could indicate a spurious relationship with one of the other demographic variables. With the other demographic variables adjusted for in the model, age was not a significant unique predictor of death competence scores post-MOOC. In the final model, baseline death competence scores were added into the equation in order to identify any unique predictors of change in death competence scores between baseline and post-MOOC. A total of 47.5% of the variance in post-MOOC death competence scores was accounted for in the final model. As expected, baseline death competence was a strong predictor of post-MOOC death competence. The only variable that maintained a significant unique association with post-MOOC death competence after partialling out the influence of pre-MOOC scores was the level of MOOC progress. Adjusting for all other factors in the model, participants who made more progress towards completing the MOOC showed significantly greater change in death competence scores by the end of the MOOC. Change in death competence scores over time could not be predicted by any socio-demographic variables, suggesting that change in death competence was likely to occur similarly for all participants, regardless of their socio-demographic characteristics, and did not benefit one demographic group more than another.

Insert Table 4 here

Discussion

To our knowledge, this is the first study to demonstrate the potential benefits for death competence of an online MOOC discussing dying for the general community. The findings of this exploratory study suggest that as a result of participating in the Dying2Learn MOOC, community members perceived themselves as being better prepared to cope with the occurrence of death in their lives, even allowing for the initial high level of death competence shown at enrolment. The gains in death competence made by participants in the MOOC imply that as a consequence of the course they felt more capable of handling what is required when faced with death, and the impact was a sizeable effect of practical significance. This finding demonstrates the potential of this type of virtual engagement in facilitating discussions about death in the general community. The nature of the MOOC format seemed to encourage participants to support each other and develop a community of practice around a topic that can be difficult for many. It is possible the non-threatening and somewhat anonymous nature of the virtual platform may enable open and honest discussions that participants may not have the opportunity to experience in their everyday lives - similar to previous reports of students in online learning contexts (e.g., Roehm & Bonnel, 2009). Dying2Learn also provided a shared space for communal discussion among peers who were treated as equal contributors to socially constructed learning. In particular, personal experiences were valued and had high currency as a learning item. Those who identified as health professionals often commented on various clinical aspects of caring for the dying (while maintaining confidentiality) but often as not were commenting on their own personal experiences as individuals who are part of a community. They, as much as non-health professionals, said they gained a lot personally from the open discussions and sharing of common life experiences.

Our findings in this research study using a validated death competence scale corroborated with the findings we obtained in the general evaluation of this MOOC in the platform, where enrolees reported feeling more comfortable talking about death at the end of the MOOC (Tieman et al., 2018). Our results in this general community sample are consistent with the findings of other previous studies of the impact of other death-related training programs offered face-to-face to hospice volunteers (Claxton-Oldfield et al., 2007; Finn Paradis & Usui, 1987; Wilkinson & Wilkinson, 1987), nurses and health workers (Brysiewicz & McInerney, 2004), and university students (Bugen, 1981; Schmidt-RioValle et al., 2012).

The positive effect of the MOOC was found despite MOOC participants being a self-selected group who had relatively high scores on death competence at the beginning of the course. Higher scores on death competence on concluding the MOOC were associated with older age, and experiencing the death of someone close in the past 5 years. These findings speak to having experience of life and death and are consistent with previous research (e.g., Robbins, 1991, 1994). Experience caring for someone with a terminal illness was also associated with higher death competence, but being a health professional was not related to death competence in this cohort. This finding contrasted with expectations that health professionals would score higher on death competence, but may be a product of the self-selected nature of the cohort. The Dying2Learn MOOC was designed and promoted for the general community but more health professionals enrolled in the course than people without a health professional qualification. It is unclear if any previous training received by these health professionals was felt to be inadequate in helping prepare them to meet the personal challenges of death work (Chan, Tin, & Wong, 2017). Alternatively, these health professionals may have deliberately sought a less formal education program that provided a unique interactive experience such as that offered by a constructivist-MOOC.

The positive impact of the MOOC on death competence over time remained after adjusting for the effect of age. Improvements in death competence while completing the MOOC did not vary depending on health professional experience or bereavement experience – the MOOC was beneficial for all participants regardless of previous exposure to death in their personal life or their experiences as a health professional. Furthermore, the amount of progress in completing the MOOC demonstrated a strong unique association with the magnitude of change in death competence by the end of the MOOC. This result is consistent with a dose-response relationship and provides support for the effectiveness of the MOOC for improving death competence.

Implications for Policy and Practice

The findings of this research highlight the potential wide-reaching benefits of online death education - opening up a forthright and respectful dialogue about death in supported online environments accompanied by educational resources may be one useful public health strategy for building death competence and literacy in all members of the general community. The quality of engagement in the MOOC demonstrates a need for fora that openly discuss a wide range of issues in relation to death and dying, with topics such as language, bereavement, talking to children, advance care planning, and euthanasia amongst the many raised over the course of Dying2Learn.

Theoretically, improvements in death competence should have an impact on a person's behaviour in the community regarding death conversations and preparedness. Talking about death in families and communities may help to re-introduce the concept of death as a normal part of life, bringing it out of the shadows and back into everyday conversations in the same way we talk about other significant life events. Doing so may lead to more people feeling capable of sharing their end-of-life wishes and reducing the distress of family members left to make decisions on others behalf when death inevitably comes. It may also better equip the community to support those bereaved.

Many health professionals who participated reported valuing the sharing of stories and personal experiences, and the ease of completing a free online course in their own time that was relevant for professional development. Many commented that they intended to approach conversations differently in both their personal and professional lives as a result of learnings from the MOOC. Their greater capacities in terms of language and instigating death-related conversations may have flow-on effects that could benefit their patients and clients.

Limitations and Directions for Future Research

The findings of this study need to be considered with the following limitations in mind. First, Bugen's (1981) Coping with Death Scale is a validated self-report questionnaire that asks about death coping cognitions, feelings and behavioural intentions. However, it relies on self-reporting of behaviours rather than objective behavioural observation. Determining the association of post-MOOC death competence scores with subsequent actual death competence behaviours followed-up over the longer term is a future research priority. Long term follow-up over several years could ascertain how former MOOC participants feel when death and dying is thrust into their lives, and how they behave regarding death preparedness (Bugen, 1981). Longitudinal research is also recommended to investigate whether health professionals can act as brokers for re-igniting conversations and awareness about death in the community. For example, could building death competence in health professionals be translated into greater death competence in their patients and clients, as mediated by the health professional's openness to discuss issues related to death and dying?

Second, our assessment of health professional status was rudimentary and did not allow deeper investigation of variations based on types of health professional roles and setting of that role, e.g., working in palliative care. Future research would benefit from more sophisticated assessment of the impact of the MOOC on participants from different health professional roles.

Third, the ability to generalise results of this study to the general population is limited by the self-selected nature of participants enrolling in a MOOC about death, and choosing to participate in the research study. Also, less than half of participants who provided data at baseline completed the death competence scale after the MOOC concluded. It is possible that those MOOC participants who felt they gained less from the course may have been less inclined to complete the post-MOOC survey. Replication of the findings in future cohorts is needed for firmer conclusions to be made.

Fourth, while this study provided the opportunity to measure change over time in death competence from beginning the MOOC through to the end, we lacked a comparison group of people measured over time who were not exposed to the MOOC (Chan et al., 2017). It is possible that repeating the completion of the death competence scale impacted on the way participants responded the second time. Also, unknown external factors concurrently occurring within the community may have caused change on death competence over time that was unrelated to involvement in the MOOC.

Finally, findings of this study using data from self-report validated scales would be strengthened by corroboration from mixed-methodologies. Whilst beyond the scope of this exploratory study, examining the rich qualitative data provided in free-text responses and comment entries in the MOOC could provide a deeper understanding of the impact of the MOOC, offer verification for the development of positive death competence, and determine whether the MOOC was regarded as a valuable learning opportunity in the words of the participants themselves.

Whilst the present study found a positive impact of the Dying2Learn MOOC on death competence, future research is required to unpack whether specific elements of the MOOC may be more important in creating these positive effects. It is unclear if it was the MOOC course content that was responsible for increases in death competence, or whether the MOOC platform design, facilitator role, or specific cohort of enrolees were the more important MOOC features that facilitated change.

Conclusions

This study found that an online learning platform in the form of a MOOC could engage community members in meaningful social discussion about death and dying, and allowed formal research to be embedded within these online environments. Engagement in the online Dying2Learn MOOC led to improvements over time in participants' self-reported death competence, and gains were greater for participants who completed more of the online course content. The significant effect of the MOOC on death competence over time remained after adjusting for the effect of age. Improvements in death competence following completion of Dying2Learn did not vary depending on health professional experience or bereavement experience – the MOOC was beneficial for all participants regardless of previous exposure to death in work or personal settings. Further exploration is required to determine whether this change in death competence can have a positive impact on participant's behaviour in the community regarding subsequent death conversations and preparedness.

References

Abel, J., & Kellehear, A. (2016). Palliative care reimagined: a needed shift. *BMJ Supportive & Palliative Care, 6*(1), 21-26. doi:10.1136/bmjspcare-2015-001009

Alcorn, S. R., Balboni, M. J., Prigerson, H. G., Reynolds, A., Phelps, A. C., Wright, A. A., Block, S. D., Peteet, J. R., Kachnic, L. A., & Balboni, T. A. (2010). If God wanted me yesterday, I wouldn't be here today: religious and spiritual themes in patients' experiences of advanced cancer. *Journal of Palliative Medicine, 13*(5), 581-588. doi: 10.1089/jpm.2009.0343

Aries, P. (1974). *Western attitudes toward death: From the Middle Ages to the present*. Baltimore: John Hopkins University Press.

Australian Bureau of Statistics. (2013). *ABS Catalogue No. 2033.0.55.001 – Technical Paper. Census of Population and Housing: Socio-Economic Indexes for Areas (SEIFA), Australia, 2011.* Canberra: ABS. Retrieved December 12, 2017, from: http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/22CEDA8038AF7A0DCA257B3B00116E34/$File/2033.0.55.001%20seifa%202011%20technical%20paper.pdf

Australian Bureau of Statistics. (2015a). *ABS Catalogue No. 2008 - Census of Population and Housing: Nature and Content, Australia, 2016.* Canberra: ABS. Retrieved December 12, 2017, from http://www.abs.gov.au/AUSSTATS/abs@.nsf/productsbyCatalogue/985591E380E97BE1CA257673001C8201?OpenDocument

Australian Bureau of Statistics. (2015b). *ABS Catalogue No. 4364.0.55.001 National Health Survey: First Results, Australia, 2014-15.* Canberra: ABS. Retrieved December 12, 2017, from http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/CDA852A349B4CEE6CA257F150009FC53/$File/national%20health%20survey%20first%20results,%202014-15.pdf

Balk, D. E. (Ed.). (2007). *Handbook of thanatology: The essential body of knowledge for the study of death, dying, and bereavement*. Northbrook, IL: Association for Death Education and Counseling, The Thanatology Association.

Brysiewicz, P., & McInerney, P. A. (2004). A pilot study of death competency amongst health workers in the Uthukela District in Kwazulu-Natal. *Curationis, 27*(3), 43-48.

Bugen, L. A. (1981). Coping: Effects of Death Education. *OMEGA - Journal of Death and Dying 11*(2), 175-183. doi: https://doi.org/10.2190/JQPA-QFHW-VQ7A-MCAK

Camarneiro, A. P. F., & Gomes, S. M. R. (2015). Translation and Validation of the Coping with Death Scale: A Study with Nurses. *Journal of Nursing Referência, 4*(7), 113-121. doi: http://dx.doi.org/10.12707/RIV14084

CareSearch. (2017). *CareSearch Research Data Management System.* Retrieved from https://www.caresearch.com.au/caresearch/tabid/129/Default.aspx

Chan, W. C. H., Tin, A. F., & Wong, K. L. Y. (2017). Effectiveness of an experiential workshop for enhancing helping professionals' self-competence in death work in Hong Kong: a randomised controlled trial. *Health and Social Care in the Community, 25*(3), 1070-1079. doi:10.1111/hsc.12407

Chapple, H. S., Bouton B. L., Chow A. Y. M., Gilbert K. R., Kosminsky P., Moore J., & Whiting P. P. (2017). The body of knowledge in thanatology: An outline. *Death Studies, 41*(2), 118-125. doi:10.1080/07481187.2016.1231000

Clark, D., Inbadas, H., Colburn, B., Forrest, C., Richards, N., Whitelaw, S., & Zaman, S. (2017). Interventions at the end of life - a taxonomy for 'overlapping consensus'. *Wellcome Open Research, 2*, 7. doi: 10.12688/wellcomeopenres.10722.1

Claxton-Oldfield, S., Crain, M., & Claxton-Oldfield, J. (2007). Death anxiety and death competency: the impact of a palliative care volunteer training program. *American Journal of Hospice and Palliative Medicine*, *23*(6), 464-468. doi: 10.1177/1049909106294882

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. New Jersey: Lawrence Erlbaum.

Corr, C. A. (2016). Teaching About Life and Living in Courses on Death and Dying. *OMEGA - Journal of Death and Dying, 73*(2), 174-187. doi: 10.1177/0030222815575902

Doka, K. J. (2015). Hannelore Wass: Death Education--An Enduring Legacy. *Death Studies, 39*(9), 545-548. doi: 10.1080/07481187.2015.1079452

Donohue, P. K., Boss, R. D., Aucott, S. W., Keene, E. A., & Teague, P. (2010). The impact of neonatologists' religiosity and spirituality on health care delivery for high-risk neonates. *Journal of Palliative Medicine, 13*(10), 1219-1224. doi: 10.1089/jpm.2010.0049

Durlak, J. A., & Riesenberg, L. A. (1991). The impact of death education. *Death Studies*, *15*(1), 39-58. doi:10.1080/07481189108252408

Fonseca, L. M., & Testoni, I. (2012). The Emergence of Thanatology and Current Practice in Death Education. *OMEGA - Journal of Death and Dying*, *64*(2), 157-169. doi: 10.2190/OM.64.2.d

Gellie, A., Mills, A., Levinson, M., Stephenson, G., & Flynn, E. (2015). Death: a foe to be conquered? Questioning the paradigm. *Age and Ageing, 44*(1), 7-10. doi: 10.1093/ageing/afu116

Gillan, P. C., van der Riet, P. J., & Jeong, S. (2014). End of life care education, past and present: A review of the literature. *Nurse Education Today, 34*(3), 331-342. doi: 10.1016/j.nedt.2013.06.009

Hughes, S., Preston, N. J., & Payne, S. A. (2016). Online learning in palliative care: does it improve practice? *European Journal of Palliative Care, 23*(5), 236-239.

John E Fetzer Institute and National Institute on Aging Working Group. (2003). *Multidimensional measurement of religiousness/spirituality for use in health research: A Report of a National Working Group supported by the Fetzer Institute in Collaboration with the National Institute on Aging.* Kalamazoo, MI: John E. Fetzer Institute. Retrieved December 12, 2017, from http://www.fetzer.org/resources/multidimensional-measurement-religiousnessspirituality-use-health-research

Kellehear, A. (2015). Death education as a public health issue. In J. Stillion & T. Attig (eds). *Death, Dying and bereavement: Contemporary perspectives, institutions and practices* (pp 221-232). New York: Springer.

Kellehear, A. (2016). Commentary: Public health approaches to palliative care – the progress so far. *Progress in Palliative Care*, *24*(1), 36-38. doi: 10.1080/09699260.2015.1103499

Kennedy, J. (2014). Characteristics of Massive Open Online Courses (MOOCs): A Research Review, 2009-2012. *Journal of Interactive Online Learning*, *13*(1). Retrieved December 12, 2017, from http://www.ncolr.org/jiol/issues/pdf/13.1.1.pdf

Kübler-Ross, E. (1969). *On death and dying*. London: Tavistock.

Loerzel, V. W., & Conner, N. (2016). Advances and Challenges: Student Reflections From an Online Death and Dying Course. *American Journal of Hospice & Palliative Medicine, 33*, 8-15. doi:10.1177/1049909114549182

Maglio, C. J., & Robinson, S. E. (1994). The Effects of Death Education on Death Anxiety: A Meta-Analysis. *OMEGA - Journal of Death and Dying, 29*(4), 319-335. doi: https://doi.org/10.2190/KEA9-2G73-AMJM-MNP6

Medical Research Council Cognition and Brain Science Unit. (2013). *Inappropriate use of a constant covariate in repeated measures ANCOVA: MRC CBSU Wiki*. Retrieved December 12, 2017, from http://imaging.mrc-cbu.cam.ac.uk/statswiki/FAQ/constantcov

Neimeyer, R. A., Moser, R. P., & Wittkowski, J. (2003). Assessing attitudes toward dying and death: Psychometric considerations. *OMEGA - Journal of Death and Dying, 47*(1), 45-76. doi: https://doi.org/10.2190/EP4R-TULM-W52G-L3EX

Noonan, K., Horsfall, D., Leonard, R., & Rosenberg J. (2016). Developing death literacy. *Progress in Palliative Care, 24*(1), 31-35. doi.org/10.1080/09699260.2015.1103498

Pallant, J. (2010). *SPSS Survival Manual*. Berkshire: McGraw Hill.

Pizzo, P. A. (2016). Thoughts about Dying in America: Enhancing the impact of one's life journey and legacy by also planning for the end of life. *Proceedings of the National Academy of Sciences of the United States of America*, *113*(46), 12908–12912. doi: org/10.1073/pnas.1614266113

Pereira, J., Palacios, M., Collin, T., Wedel, R., Galloway, L., Murray, A., Violato, C., & Lockyer, J. (2008). The impact of a hybrid online and classroom-based course on palliative care competencies of family medicine residents. *Journal of Palliative Medicine, 22*, 929-37. doi: 10.1177/0269216308094561

Paradis, L. F., & Usui, W. M. (1987). Hospice volunteers: the impact of personality characteristics on retention and job performance. *Hospice Journal, 3*(1), 3-30.

Productivity Commission. (2013). *An Ageing Australia: Preparing for the Future*. Productivity Commission Research Paper. Canberra: Productivity Commission, Commonwealth of Australia.

Pulsford, D., Jackson, G., O'Brien, T., Yates, S., & Duxbury, J. (2013). Classroom-based and distance learning education and training courses in end-of-life care for health and social care staff: A systematic review. *Palliative Medicine, 27*(3), 221-235. doi: 10.1177/0269216311429496

Rawlings, D., Miller-Lewis, L., Collien, D., Tieman J., Parker D., & Sanderson, C. (2017). Lessons Learned from the Dying2Learn MOOC: Pedagogy, Platforms and Partnerships. *Education Sciences, 7*(3), 67. doi:10.3390/educsci7030067

Rawlings, D., Tieman, J. T., Sanderson, C., Parker, D., & Miller-Lewis, L. (2017). Never say die: Death euphemisms, misunderstandings and implications for practice. *International Journal of Palliative Nursing*, *23*(7), 324-330. doi.org/10.12968/ijpn.2017.23.7.324

Reed, E., Todd, J., Lawton, S., Grant, R., Sadler, C., Berg, J., Lucas, C., & Watson, M. (2017). A multi-professional educational intervention to improve and sustain respondents' confidence to deliver palliative care: A mixed-methods study. *Palliative Medicine*, Epub ahead of print, 1-10. doi: https://doi.org/10.1177/0269216317709973

Robbins, R. A. (1991). Bugen's Coping with Death Scale: Reliability and Further Validation. *OMEGA - Journal of Death and Dying, 22*(4), 287-299. doi:10.2190/hntd-rwrw-y3yn-vwx1

Robbins, R.A. (1994). Death competency: Bugen's coping with death scale and self efficacy. In R.A. Neimeyer (Ed.), *Death Anxiety Handbook: Research, Instrumentation, and Application* (pp. 149-165). Washington DC: Taylor and Francis.

Roehm, S., & Bonnel, W. (2009). Engaging students for learning with online discussions. *Teaching and Learning in Nursing, 4*(1), 6-9. doi: https://doi.org/10.1016/j.teln.2008.07.003

Schmidt-RioValle, J., Montoya-Juarez, R., Campos-Calderon, C. P., Garcia-Caro, M. P., Prados-Peña, D., & Cruz-Quintana, F. (2012). The effects of a training program on coping with death in palliative care. *Medicina Paliativa, 19*(3), 113-120. doi: 10.1016/j.medipa.2010.11.001

Sofka, C., Cupit, I. N., & Gilbert, K. E. (2012). *Dying, Death, and Grief in an Online Universe: For Counselors and Educators*. New York: Springer Publishing Company.

Swerissen, H., & Duckett, S. J. (2015). What can we do to help Australians die the way they want to? *The Medical Journal of Australia, 202*(1), 10-11. doi: 10.5694/mja14.01580

Tieman, J., Miller-Lewis, L., Rawlings, D., Parker, D., & Sanderson, C. (2018). The contribution of a MOOC to community discussions around death and dying. *BMC Palliative Care, 17*(1), 31. doi:10.1186/s12904-018-0287-3

URBIS. (2016). *Evaluation of the National Palliative Care Strategy 2010 Final Report*. Prepared for the Commonwealth Department of Health. Canberra: Commonwealth Department of Health.

Van Breukelen, G. J., & Van Dijk, K. R. (2007). Use of covariates in randomized controlled trials. *Journal of the International Neuropsychological Society, 13*(5), 903-904.

Vandenbroucke, J. P., von Elm, E., Altman, D. G., Gøtzsche, P. C., Mulrow, C. D., Pocock, S. J., Poole, C., Schlesselman, J. J., & Egger, M. (2007). Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): Explanation and Elaboration. *PLOS Medicine, 4*(10), e297, 1628-1654. doi: https://doi.org/10.1371/journal.pmed.0040297

Wass, H. (2004). A perspective on the current state of death education. *Death Studies, 28*(4), 289-308. doi: 10.1080/07481180490432315

Wilkinson, H. J., & Wilkinson, J. W. (1987). Evaluation of a Hospice Volunteer Training Program. *OMEGA - Journal of Death and Dying, 17*(3), 263-275. doi: https://doi.org/10.2190/AKX4-NGU0-07X2-MWQ4

Figure 1

Participation Flow Chart

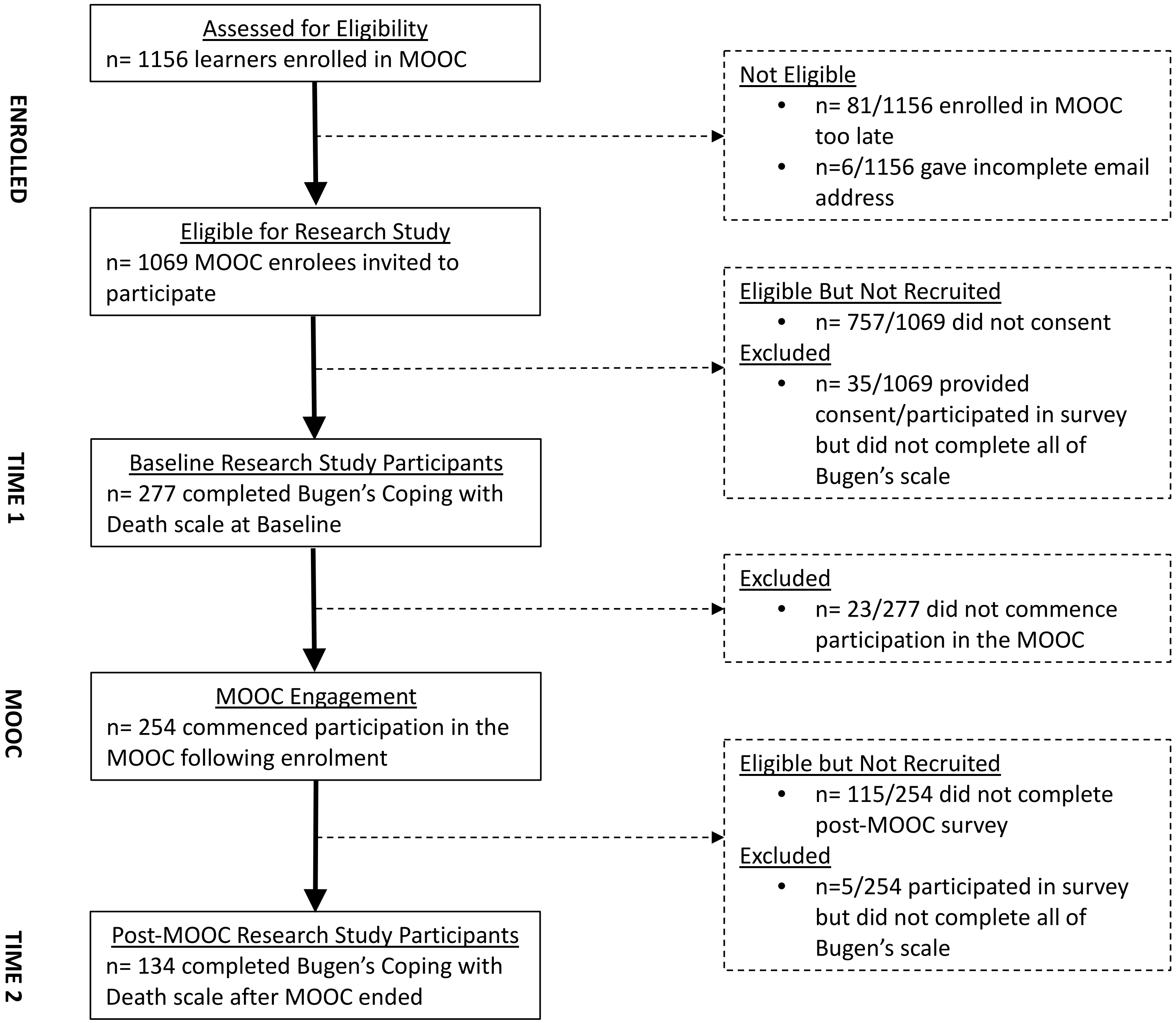

Table 1

Descriptive Statistics on Socio-demographic and MOOC Engagement Variables for MOOC Research Study Participants (Complete Cases n=134 and Response Sample at Baseline n=277)

	Complete Cases MOOC Research Study Participants (n= 134)		*Response Sample MOOC Research Study Participants (n= 277)*	
	Valid n	*% or M (SD), range*	*Valid n*	*% or M (SD), range*
Socio-Demographic Characteristics at Enrolment				
Gender (female)	134	94.0%	277	95.6%
Age	133	54.03 (12.1), 22-76	276	52.93 (12.4) 19-84
Located in Australia	134	90.3%	277	93.1%
SEIFA Disadvantage Index for Aust Postcode [a]	121	1016.1 (58.2), 850.2-1117.3	257	1010.64 (58.3), 816.6-1117.3
Self-identifies as a Health Professional	134	53.7%	277	64.3% [b]
Has a University Qualification	134	76.9%	277	70.4% [c]
Highest Level of Education:	134	-	277	
Some High School	-	2.2%	-	4.0%
Completed High School	-	6.7%	-	7.6%
Trade school or Equivalent	-	14.2%	-	18.1%
University Studies	-	76.9%	-	70.4%
Socio-Demographic Characteristics at Baseline				
Carer experience (yes)	133	67.7%	277	69.6%
Death experience (yes)	134	67.9%	277	68.2%
Self-Assessed Health:	134		277	
Excellent	-	20.1%	-	18.4%
Very Good	-	44.8%	-	45.5%
Good	-	29.9%	-	30.7%
Fair	-	5.2%	-	5.4%
Poor	-	0%	-	0%
Australian Born	134	67.2%	277	67.9%
Identifies with Australian Culture	134	70.9%	267	70.4%
Spirituality:	134		277	
Not spiritual at all	-	6.0%	-	5.8%
Slightly spiritual	-	26.1%	-	27.4%
Moderately spiritual	-	35.8%	-	37.7%
Very spiritual	-	32.1%	-	28.9%
Religiousness:	134		277	
Not religious at all	-	40.3%	-	44.8%
Slightly religious	-	31.3%	-	31.4%
Moderately religious	-	23.1%	-	18.8%
Very religious	-	5.2%	-	5.1%
MOOC Engagement Outcomes				
Total percent of Progress made in course content by the end of the MOOC [d]	134	65.79 (23.75), 6-96	277	45.92 (31.86), 0-98 [e]
No. of comments made during MOOC	134	25.10 (32.36), 0-265	277	15.88 (25.12), 0-265 [f]

a. SEIFA scores are only generated for participants residing in Australia with an Australian postcode; n=257 of the research study participants at baseline and n=121 of the complete case sample with data at both baseline and post-MOOC.

b. There was a statistically significant difference between participants retained and those lost to attrition on health professional status. Those who were lost to attrition were more likely to self-identify as health professionals; Chi-Square Test of Independence *χ2* (*df* = 1)=12.53, *p*=.000.

c. There was a statistically significant difference between participants retained and those lost to attrition on highest education. Those who were lost to attrition had a lower level of education; Independent samples *t-test* (*df*=269.57)= -2.21, *p*=.028. Specifically, they were less likely to have a university education; Chi-Square Test of Independence *χ2* (*df*=1)=5.21, *p*=.022.

d. An activity in the MOOC platform failed to properly register as complete for participants, meaning that the maximum possible completion score participants could receive was 98 percent.

e. There was a statistically significant difference between participants retained and those lost to attrition on the level of progress made in completing the MOOC. Those who were lost to attrition made less progress with the MOOC; Independent samples *t-test* (*df*=275)= -12.60, *p*=.000.

f. There was a statistically significant difference between participants retained and those lost to attrition on the level number of comments made in the MOOC. Those who were lost to attrition made less comments in the MOOC; Independent samples *t-test* (*df*=154.51)= -6.14, *p*=.000

Table 2

Bivariate Relationships between socio-demographic variables, MOOC engagement, and Death Competence Scores at Baseline and Post-MOOC, Complete Cases, n=134[a].

	Baseline Death Competence score		*Post-MOOC Death Competence score*	
	r or t (df)[b]	*p*	*r or t (df)*[b]	*p*
Socio-Demographic Characteristics				
Gender (female)	.851 (131)	.396	.127 (131)	.899
Age	.358	.0005	.233	.010
Located in Australia	.980 (132)	.329	1.05 (132)	.296
SEIFA Disadvantage Index for Aust Postcode[c]	-.002	.982	-.155	.090
Self-identifies as a Health Professional	1.02 (132)	.311	.555 (132)	.580
Highest Level of Education	.061	.484	-.009	.914
Carer experience	-2.62 (131)	.010	-2.56 (131)	.012
Death experience	-3.37 (66.12)	.001	-2.48 (63.15)	.016
Australian Born	1.24 (132)	.216	1.45 (132)	.149
Identifies with Australian Culture	-0.75 (132)	.453	.267 (132)	.790
Self-Assessed Health Status	-.107	.218	-.135	.120
Religiousness	.206	.017	.093	.288
Spirituality	.285	.001	.188	.029
MOOC Engagement				
Total percent of Progress made in course content by the end of the MOOC	.105	.228	.241	.005
No. of comments made during the MOOC	.041	.642	.063	.469

a. Due to missing data, analysis including the dichotomised gender variable included n=133 participants, and analysis with age included n=133 participants.

b. Dichotomous demographic variables were analysed using Independent samples t-test, and ordinal and continuous variable were analysed using Pearson's r correlations.

c. SEIFA scores are only generated for participants residing in Australia with an Australian postcode. n=121 of the 134 complete cases.

Table 3.

Mixed Between-Within Repeated-Measures ANOVAs Results: Death Competence Pre-MOOC and Post-MOOC, adjusted for age

	Between Subjects Factors			
	Occupation		*Death Experience*	
	Health Professional *n=72*	*Other Occupation* *n=61*	*No Death Experience* *n=43*	*Death Experience* *n=90*
Outcome [a,b,c,d,]	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*
Pre-MOOC Death Competence	156.07 (26.94)	161.84 (24.73)	146.44 (29.89)	164.58 (21.78)
Post-MOOC Death Competence	164.86 (23.61)	167.99 (18.64)	158.33 (26.24)	170.10 (17.67)
Time Effects				
Wilks Lambda	.873		.860	
F (1, 130)	18.99		21.20	
P	.0005		.0005	
Partial Eta^2	.127		.140	
Group Effects				
F (1, 130)	0.009		12.71	
P	.925		.001	
Partial Eta^2	.000		.089	
*Time*Group Interaction Effect*				
Wilks Lambda	1.0		.986	
F (1, 130)	0.005		1.88	
P	.998		.173	
Partial Eta^2	.000		.014	

Notes.

[a] F (df) for all statistics = 1,130. N=133 due to one person missing data on age.

[b] Results presented are representative of effects after adjusting for age.

[c] These 2 sets of Mixed Between-Within ANOVAs included age (centred) as a covariate. In the Model including Occupation, the between-subjects main effect for age was significant, *F* (1, 130) = 14.01, *p* = .0005, Partial Eta^2 = .097. In the Model including Death Experience, the between-subjects main effect for age was significant, *F* (1, 130) = 12.84, *p* = .0005, Partial Eta^2 = .090. Of note is that in both models shown in Table 3, there was a statistically significant interaction between age and time, (model including occupation: *Wilks' Lambda*=.954, *F*(1, 130)= 6.22, *p*=.014, small effect with *Partial Eta*^{2}=.046; model including death experience: *Wilks' Lambda*=.957, *F*(1, 130)=5.79, *p*=.018, small effect with *Partial Eta*^{2}=.043. This suggested that the effect of the MOOC on death competence over time depended on the participants' age. To explore this finding more, we conducted a Mixed ANOVA with repeated-measures for death competence, including age as a between-subject factor. Age was categorised into tertiles in order to plot any interaction effect (Medical Research Council Cognition and Brain Science Unit, 2013; Van Brukelen, 2007). Participants aged 52 or younger (bottom tertile) had a mean death competence score of 146.16 (*SD*=26.2) at baseline and 156.45 (*SD*=24.2) post-MOOC; those aged 53-59 (middle tertile) had a mean death competence score of 161.09 (*SD*=22.1) at baseline and 169.65 (*SD*=17.7) post-MOOC; and those aged 60 or over (top tertile) had a death competence score of 169.18 (*SD*=24.6) at baseline and 173.02 (*SD*=18.5) post-MOOC. Whilst the mean increase in death competence was greater in the younger age group, the interaction effect between time and age group did not reach statistical significance in the model, *Wilks' Lambda*=.982, *F*(2,130)=1.20, *p*=.308, *Partial Eta*^{2}=.018. The repeated-measures main effect of time was significant, *Wilks' Lambda*=.876 *F*(1,130)=18.41, *p*=.0005, *Partial Eta*^{2}=.124. The between-subjects main effect of age group was significant, *F*(2,130)=11.54, *p*=.0005, *Partial Eta*^{2}=.151 (large effect size). There was a significant difference in death competence scores for the three age groups. Post-Hoc Tukey tests indicated that the mean differences in death competence scores of the younger age group (age 52 or younger) were significantly different from both of the older age groups (*p*=.003 and *p*=.0005 respectively), but the middle age group and the older age group did not differ significantly on death competence scores (*p*=.375). Overall, the younger age group had lower death competence scores.

[d] We also conducted a Mixed ANOVA that combined the two models above, by including both occupation and death experience as between-subjects factors in the same model. The results obtained were almost identical to those presented here.

Table 4.

Hierarchical Multiple Linear Regression Predicting Post-MOOC Death Competence, adjusting for Baseline Death Competence (n=132) [a]

	Post-MOOC Death Competence					
Baseline Predictor Variables [b c]	*Unstandardised B (Standardised β)*	*95%CI*	*p*	*R^2 (ΔR^2)*	*ΔF*	*p*
Initial Model:				.231 (.161)	3.28	.001
Age	.248 (.140)	-.07 to .56	.121			
Total % Progress made in MOOC	.250 (.279)	.10 to .41	.002			
No. of comments made in MOOC	-.035 (-.053)	-.15 to .08	.559			
Gender (female)	-.525 (-.006)	-16.30 to 15.25	.948			
Australian Born (Yes)	-6.859 (-.150)	-14.39 to .67	.074			
Health Professional (Yes)	-2.892 (-.067)	-10.26 to 4.47	.438			
Highest Level of Education	.051 (.002)	-4.87 to 4.98	.984			
Self-Assessed Health Status [d]	-4.815 (-.184)	-9.26 to -.37	.034			
Death Experience (Yes)	10.019 (.220)	2.58 to 17.46	.009			
Religiousness	-.455 (-.020)	-4.71 to 3.80	.832			
Spirituality	3.562 (.151)	-.68 to 7.80	.099			
Final Model (adjusting for Baseline Bugen score):				.475 (.423)	55.39	.0005
Age	-.035 (-.020)	-.31 to .24	.801			
Total % Progress made in MOOC	.184 (.205)	.06 to .31	.006			
No. of comments made in MOOC	-.004 (-.006)	-.10 to .10	.936			
Gender (female)	.272 (.003)	-12.82 to 13.36	.967			
Australian Born (Yes)	-4.537 (-.099)	-10.81 to 1.74	.155			
Health Professional (Yes)	-1.044 (-.024)	-7.17 to 5.09	.737			
Highest Level of Education	-1.857 (-.061)	-5.97 to 2.26	.373			
Self-Assessed Health Status [d]	-2.482 (-.095)	-6.22 to 1.26	.192			
Death Experience (Yes)	2.685 (.059)	-3.79 to 9.16	.413			
Religiousness	-1.317 (-.057)	-4.85 to 2.22	.462			
Spirituality	.540 (.023)	-3.07 to 4.15	.767			
Baseline Death Competence score	.489 (.595)	.36 to .62	.000			

Notes.

[a] Of the 134 complete cases with data on death competence at both assessments, one was missing data on age and one was missing data on gender. Therefore the multiple regression had a total n of 132.

[b] Collinearity diagnostics indicated the potential presence of multicollinearity between carer experience and death experiences; and between Australian culture, Australian residence, and being Australian born. Therefore this multivariable analyses excluded carer experience, Australian culture, and Australian Residence.

[c] Valid data on the SEIFA disadvantage index only exists for participants who reside in Australia (n=119). We tested a model with Australian residents only to assess the association of SIEFA disadvantage to post-MOOC death competence. The results were very similar to those reported above (Final model R^2 =.482, *F*[13, 105]=7.51, *p*=.0005). In the final model, SEIFA disadvantage held a negative association with post-MOOC death competence, after adjusting for baseline death competence. This small association approached statistical significance (*B*=-.052; *Beta*=-.139, 95%CI= -.106 to .003, *p*=.065). MOOC participants who had higher SEIFA scores (indicating more advantaged area), had lower post-MOOC death competence scores after adjusting for scores at baseline, indicating that those living in more advantaged areas showed slightly less change over time on death competence.

[d] On self-assessed health status, higher scores indicate poorer health.