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Yale School of Medicine

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Development, Implementation, and Evaluation of an End of Life Care Online Module for
Pre-Clinical Students

A Thesis Submitted to the
Yale University School of Medicine
in Partial Fulfillment of the Requirements for the
Degree of Doctor of Medicine

by
Chung Sang Tse
2015

ABSTRACT

Basic palliative and end-of-life care skills are necessary for all physicians regardless of their field of specialty. Education should begin during the early stages of medical training, as early as medical school, to ensure that all physicians acquire a basic understanding of these aspects of medical care. At the Yale School of Medicine, the End-of-Life and Palliative Care Curriculum was formalized in 2008 to address this need and was expanded in 2012 to include an original educational online module. This new module was designed specifically for second-year medical students, who had the opportunity to visit hospice patients but do not have dedicated learning prior, to introduce them to specific topics in end-of-life and palliative care in preparation for third-year clerkship rotations during which they are likely to encounter and care for dying patients.

“Life, Death & Medicine: The Dying Process, Hospice Care, and Terminal Care” was developed as a 30-45 minute interactive web-based module that focused on three topics: 1) the physiological signs and stages of the dying process; 2) the common terminal symptoms and their treatments; and 3) the eligibility and services of hospice care. The educational content is literature-based with reference citations embedded within the module. Several interactive features augment this online module, including multiple-choice questions with individualized feedback, drag-and-drop pairing exercises, video clips, and supplementary materials accessed via web-links.

To evaluate the effectiveness of the module, a knowledge-and-attitudes survey was created and administered to second-year Yale medical students randomized to either have or not have access to the module prior to a required half-day hospice/palliative care rotation. A total of 152 students (51% response rate; 62 students in 2012; 66 in 2013; and 24 in 2014) participated in

the survey between September 2012 to November 2014, of which 56 students had completed the online module and 85 had not (control group). Multinomial logistic regression was used to analyze the students' knowledge performance based on a series of multiple-choice questions. Multivariate ANOVA was used to analyze the students' attitudes based on their degree of agreement to a series of attitude-assessing statements. Students who completed the online module scored higher ($p < .05$) on five out of eight of the knowledge-assessing questions. Overall, the students expressed that they felt somewhat uncomfortable caring for dying patients, though they regarded it as part of the physician's duty, and that palliative care education is important in medical curricula. The attitudes did not differ between the students who completed the module and those who did not.

“Life, Death & Medicine: The Dying Process, Hospice Care, and Terminal Care” is a promising tool to introduce pre-clinical medical students to key concepts of terminal care. The application of this online module can be extended to other medical schools to augment teaching of palliative and end-of-life care.

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INTRODUCTION

Background

Modern medicine is more successful than ever at treating diseases and managing illnesses. In the early 1900s, the average life expectancy was 50 years and people often experienced a relatively quick death, often due to infectious diseases or accidental injuries (Emanuel, von Gunten, and Ferris 2000, 1176-1180). In comparison, the citizens of the 21st often die after a substantial period of disability, living for years to decades with gradual decline from chronic diseases (Lynn et al. 2000, 254-267). When patients reach the point of succumbing to life-threatening health problems or catastrophic accidents, medical advances have made it possible to keep these patients alive without necessarily improving their quality of life. Amidst an expanding aging population, it is important for physicians to recognize and reconcile the potentials and limitations of modern medicine. Goals of care have traditionally had a curative and life prolonging intent, though in recent times there has been a growing emphasis on ensuring patient comfort and maximizing quality of life.

Palliative care “anticipates, prevents and treats suffering throughout the continuum of illness for all seriously ill patients, including but not limited to those at the very end of life” (Horowitz, Gramling, and Quill 2014, 59-66). The principles of palliative care include minimization of pain and distress; enhancement of quality of life; provision of care by an interdisciplinary team; integration of psychological and spiritual care; and support for families in coping with the illness and bereavement (O'Neill and Fallon 1997, 801-804). The goal is to help people “live as well as they can for as long as they can” and “[care] for the patient and family throughout the course of illness, no

matter where it takes them” (Horowitz, Gramling, and Quill 2014, 59-66). Hospice care, in particular, is end-of-life care that is provided for patients with a life expectancy of six months or less. Hospice services are covered by Medicare (and other payers) and can be provided at home, at a hospice facility, in the hospital, or at a skilled nursing facility (National Institute of Health 2012).

The Need for Palliative Care Education

Basic palliative care competencies apply to all medical specialties. Every clinician will likely care for terminally ill and dying patients during their career. In primary care practice, family physicians are estimated to have twenty of their patients die each year: two from sudden, unexpected causes; five from cancer; and thirteen from chronic diseases such as heart failure, chronic lung diseases, and dementia (Watson 2008, 250-256). Specialties across the board recognize the importance of palliative care – in fact, the American Board of Medical Specialties (ABMS) approval of Hospice and Palliative Care as a subspecialty was based on support from 10 sponsoring boards: internal medicine, surgery, anesthesiology, family medicine, emergency medicine, pediatrics, physical medicine and rehabilitation, obstetrics and gynecology, psychiatry and neurology, and radiology (Portenoy et al. 2006, 21-23). Given the broad consensus on the necessity for all physicians to learn skills in end of life care, education on palliative care and hospice care should extend to every medical student, resident, and fellow as a fundamental part of clinical training.

Teaching about end of life care increases students' satisfaction with their medical education (Billings et al. 2010, 319-326). Despite this impetus, graduating medical students in the United States feel unprepared to provide end-of-life care and desire more education in palliative medicine (Romotzky et al. 2014, 1-7; Ellman et al. 2009, 18-23). The Graduation Questionnaire conducted between 2009 – 2013 by the Association of American Medical Colleges showed that one-fifth (19.2 - 22.1%) of U.S. medical graduates felt that they received “inadequate” instruction (as opposed to “appropriate” or “excessive”) in palliative care/pain management or end of life care (17.6-19.2% for “inadequate” instruction) (American Association of Medical Colleges 2013).

Brief History of End-of-Life and Palliative Care Education

Five decades ago, end-of-life care first gained popular attention and professional acknowledgement and much has changed since then to formalize palliative care as a critical component of medical training. In the late 1960s, formal education on end-of-life care first entered into the medical school curriculum (Liston 1973, 577-578). At that time, only half of the medical schools offered any formal teachings on the dying patient, and these were in the forms of lectures, seminars, patient interviews, videotape recordings (most commonly depicting role-playing), and less commonly, assigned readings or visits to geriatric facilities. In the 1970s, the “death education curricula” markedly expanded (Smith, McSweeney, and Katz 1980, 844-850) such that 87% (93 out of 107 schools surveyed) had formal death education courses by the mid-1970s (Dickinson 1976, 134-136). By the year 2000, all U.S. medical schools offered some form of teaching on death and dying (Dickinson 2006, 197-204). Since then, the Liaison Committee on Medical

Education (LCME) has made it a requirement for all accredited US/Canadian medical school curricula to include ‘important aspects of ... end-of-life care’, although the precise approach, time, or modalities for end-of-life education have not yet been specified (Liaison Committee on Medical Education 2013, 27 November 2014).. Formal teaching in the form of lectures and seminars remain the mainstay of teaching, though throughout the years the trend towards decreasing the use of video/film has been matched with an increase in hospice visits and clinical case discussions (Dickinson 2006, 197-204; Dickinson 2011, 412-417).

As time passed, not only did the number of curricula containing death and dying change, but the format in which it is taught evolved. With the advent of computers and popularization of online teaching tools, e-learning began to play a role in medical education in the 1990s (Ruiz, Mintzer, and Leipzig 2006, 207-212). Students nowadays are sometimes deemed as “digital natives” who were born into a world where computers are prevalent and relevant to their work, learning, and play (Downes 2005, 1). As Downes puts it, this new generation of students “absorb information quickly, in images and video as well as text, from multiple sources simultaneously. They operate at ‘twitch speed,’ expecting instant responses and feedback. They prefer random ‘on demand’ access to media...” In turn, teaching has adapted to this and there is a trend towards “learner-centered” or “student-centered” designs. Students are given more control over their own learning, the pace, the format, and the mode of content delivery. Autonomy of the learner is emphasized alongside with active learning. E-learning responds well to this as it allows learning to be individualized, collaborative, and transformative (Ruiz, Mintzer, and Leipzig 2006, 207-212). E-learning can be seen as an innovation that is

revolutionizing the world of education and meeting the needs and characteristics of the new generation of students in the digital age.

E-Learning in Medicine

E-learning can improve the effectiveness in medical education amidst a paradigm shift from instructor-centered teaching to a learner-centered model. Increasingly, there is an emphasis in medical school and residency to put learners in control of their own learning. Online case-based modules, virtual discussion forums, image banks, and self-assessment questions are some of the ways in which different medical fields have utilized web-based learning at various levels of medical training (Larvin 2009, 133-137; Radon et al. 2006, 93-98; Kolb et al. 2007, 553-557). In congruence with the adult learning theory, e-learning technologies offer the means for students to learn by relating new material to old experiences, linking learning to specific needs, and applying learning in a practical manner (Gibbons and Fairweather 1998). For example, at the University of Birmingham, 179 first year medical students were randomized to either a computer-based session or a face-to-face lecture of equal duration (40 minutes) on the topic of evidence-based medicine (literature searching, critical appraisal of systematic reviews, and question framing) (Davis et al. 2007, 23). Using a validated pre- and post-intervention questionnaire, the researchers found that the knowledge gained from computer-based teaching was equivalent to lecture-based teaching. A meta-analysis of e-learning in the health professions from 1990 through 2007 also suggests that the effectiveness of internet-based learning was similar to traditional methods (Cook et al. 2008, 1181-1196).

Online Tools for Palliative Care Education

E-learning has been piloted in the palliative care and end-of-life care education of medical students (Gibbins et al. 2009, 776-783; Orton and Mulhausen 2008, 73-88; Huang, Reynolds, and Candler 2007, 446-451; Keyte and Richardson 2011, 117-121; Ellman et al. 2012, 1240-1247; Tan, Ross, and Duerksen 2013, 22711), residents (Pereira et al. 2008, 929-937; Gisondi et al. 2010, 491-499), fellows (Block 2002, 243-248), physicians (Robinson et al. 2004, 637-645; Grant et al. 2009, 327-335; Pelayo et al. 2011, 37-2296-12-37), and healthcare staff (McDonald et al. 2009; Pulsford et al. 2013, 221-235; Arenella et al. 2010, 418-421). At the University of Alberta, Tan et. al developed an online virtual patient clinical case in palliative care for third-year medical students rotating in the family medicine clerkship in 2010-2011 (Tan, Ross, and Duerksen 2013, 22711). The virtual patient case was an interactive computer simulation of a 68-year old man with non-small cell lung cancer presenting with a new onset of back pain. The case simulated longitudinal care of this patient from the diagnosis of bony metastases, to hospice admission, and finally to death. The students were guided through topics of symptom management and psychological support for the patient and family. The main interactive feature employed in this virtual patient case was short answer and multiple choice questions (MCQ). Through pre- and post- course surveys, the researchers found that students who completed the virtual patient case had significant increases ($p < 0.0001$) in knowledge scores and self-assessed comfort levels. Moreover, the vast majority of the students thought that the virtual patient case was realistic, emotionally engaging, and educationally beneficial.

Blended curricula, where educational content is delivered in part online and combined with face-to-face teaching, have also been reported (Kim 2007, 1-8). At the Yale School of Medicine, Ellman et al. developed a palliative care educational program for third-year medical students that includes an online interactive, case-based module and a live, dynamic simulation workshop (Ellman et al. 2012, 1240-1247). The online case depicts the course of a 68-year old African American woman with end-stage metastatic breast cancer. Through the web-based platform, students explore the spiritual and cultural issues impacting the patient and her family, including the family's hope for a miracle and the patients' spiritual distress in the context of a terminal illness. This was followed by a 90-minute interdisciplinary workshop with students in nursing, medicine, and divinity degree studies who engaged in small-group, problem-based learning. Evaluation of this program showed that professionally diverse groups of students successfully engaged in collaborative palliative care learning, with an increase in self-reported understanding of the basic precepts and goals of palliative care (Ellman et al. 2012, 1240-1247).

Palliative and End-of-Life Care Education at Yale School of Medicine

In 2008, the Yale School of Medicine implemented a longitudinal palliative and end-of-life care curriculum over the four years of medical school. It is a comprehensive, blended learning curriculum composed of didactics, hospice visits, online modules, and workshops that aims to provide students with the basic knowledge and skills to address the physical, psychosocial, and spiritual needs of terminal patients and their families. In the first year of medical school, students observe and participate in the interview of a patient with terminal illness. In the second year, groups of three to five students spend an

afternoon with a hospice/palliative care clinician visiting patients at hospital/home hospice. In the clerkship year, students complete a ward-based patient refection assignment, three online modules, and participate in an interdisciplinary workshop with students and faculty members from Medicine, Nursing, Social Work, and Inter-professional Chaplaincy. In the graduating year, students participate in the “Terminal Illness in the Primary Care Setting” workshop and a class on Do Not Resuscitate (DNR) orders, death pronouncement, and death notification. A Hospice and Palliative Medicine elective is offered to fourth year medical students. More information about the curriculum can be found at the Yale School of Medicine Palliative and End-of-Life Care Education website: <http://palliativecare.yale.edu/curriculum/index.aspx> .

In 2012, I approached Dr. Matthew Ellman, MD, the Director of Medical Student Palliative and End-of-Life Care Education, to explore ways in which I could help expand the existing curriculum. He suggested that the current curriculum would benefit from additional teaching on hospice care and the natural dying process. Thus began the development of the online module “Life, Death, and Medicine: the Dying Process, Terminal Care, and Hospice Care” (henceforth referred to as the “EOL online module”).

STATEMENT OF PURPOSE & HYPOTHESIS

STATEMENT OF PURPOSE

To complement and enrich the palliative and end-of-life care curriculum at the Yale School of Medicine through an evidence-based, innovative teaching modality.

HYPOTHESIS

The following hypothesis was proposed:

The EOL online module will increase the students' knowledge on 1) the dying process, 2) terminal care, and 3) hospice care, but not have a significant effect on the students' attitudes about self-perceived competence (comfort) in caring for dying patients.

Given the promising research of other e-learning initiatives in improving the domain knowledge as evaluated by short-answer and multiple choice tests, we postulated that a well-researched and well-designed online module will likewise improve the students' knowledge in the specific topic areas corresponding to the learning objectives. However, we were skeptical as to whether a short, one-time use of an online module would have as large an impact on the students' self-perceived competency to provide end-of-life care as actual clinical experiences with hospice/palliative patients might.

METHODS

Preparing for the EOL online module development - EOL Student Fellowship

In the summer of 2012, I participated in the AMSA-VITAS End-of-Life Fellowship Program, a 6-week immersive program hosted by the American Medical Students Association (AMSA) and VITAS Hospice at Fort Lauderdale, FL. Dr. Matthew Ellman served as my mentor at my home institution (Yale School of Medicine). Through the program, I engaged in field and didactic experiences to learn about palliative and hospice care directly from specialized physicians, nurses, social workers, and chaplains. The field experiences involved seeing patients with hospice care team members at nursing homes, private residential homes (home hospice), and in-patient hospice units. The curriculum included topics on end of life care delivery systems, interdisciplinary care team, hospice eligibility and services, patient assessment, pain management, terminal symptoms management (e.g., depression, anxiety, and delirium), nutrition and hydration, spiritual and ethical issues (including Buddhism, Christianity, and Judaism), bereavement care, and pediatric hospice care.

Developing the EOL online module

Following my participation in the fellowship program, I spent one dedicated month creating an online module entitled “Life, Death, and Medicine: the Dying Process, Terminal Care, and Hospice Care” with the purpose of introducing second-year medical students to key aspects of terminal care that would be important for starting third-year clerkship. The learning objectives of the module were for students to be able to:

1. Identify the key physiological and psychosocial aspects in the three stages of the dying process
2. Recognize common end-of-life symptoms and their treatment options
3. Explain hospice care eligibility and services

The online module was created on Qualtrics©, an online survey platform licensed by Yale University that allows educators to create custom content and implement optional interactive features. I created a 30-45 minute module, the first page of which is shown in **Figure 1**, that contains three case studies: an 87-year old Asian woman with end stage renal disease to illustrate the three stages of the dying process (**Figure 2**); a 54-year old Hispanic man with end stage chronic obstructive pulmonary disease to introduce the treatments for common terminal symptoms; and a 70-year old African American man with metastatic bladder cancer to explain hospice care eligibility and services. The module has 15 webpages, 29 questions, and two multimedia clips, one of which is a video clip of Cheyne-Stokes breathing (**Figure 3**) and the other is a sound clip of the death rattle. The interactive features of this module include embedded multiple choice questions with individualized feedback (**Figure 4**), drop-down lists, scripted dialogue, and mix-and-match pairing. The content is based on published literature, and the reference citations are listed alongside the corresponding module content. The primary reference for this module was the book “End-of-Life Care: A Practical Guideline” by Barry Kinzbrunner, M.D. and Joel Policzer, M.D. In addition, there were eight additional reference citations to journal articles and online publications.

The EOL online module can be accessed at the following web-link:
https://yalesurvey.qualtrics.com/SE/?SID=SV_1MO7Jw6hxAocTgp

Figure 1: EOL Online Module's First Page

Life, Death, & Medicine: The Dying Process, Hospice Care, and Terminal Care

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Life, Death, & Medicine: The Dying Process, Terminal Care, & Hospice Care

**"Each of us is mortal. We're born, we live, we make our mark and, when it's time, we die."
- Maureen Kramlinger, MA, CT; VTAS, "Making the Most of the Time We Have"**

**"During the final days of the patient's life, attention is specifically focused on ensuring patient comfort and dignity as that life draws to its inevitable conclusion."
- Dr. Barry Kinzbrunner, MD, and Dr. Joel Policzer, MD, "End-of-Life Care: A Practical Guide"**

Why should you learn about Palliative Care and End-of-Life Care?

- **You will care for patients who will, one day, face death.** Medicine is a profession that inherently deals with issues of life and death. Physicians should not only help patients to live well, but also to die with dignity.
- **An increasing proportion of Americans living longer and have chronic illnesses.** There is a great need for all physicians to be trained in providing both curative care and palliative care within their specialties.
- **You have the duty to fulfill a social, moral, and ethical obligation** to provide medical care for patients who are dying. It is important for health professionals to know how to recognize and treat terminal symptoms.

As a member of the healthcare team, your role is to help address the patients' physical and psychosocial needs. In this module, you will encounter three patients - Mrs. Chin, Mr. Johnson, and Mr. Lopez - who are in the terminal stages of their illnesses.

Learning Objectives

Part 1: The Dying Process

- Know the definitions of the three stages of the dying process
- Identify key physiological features and psychosocial aspects of dying

Part 2: Hospice Care

- Explain the goals of hospice care (vs. curative)
- Identify the services provided by hospice
- Describe the qualifications (administrative criteria) for hospice care

Part 3: Terminal Care

Recognize the common symptoms that accompany the dying process and how to treat them, including:

1. Anxiety
2. Fatigue
3. Pain
4. Dyspnea
5. Anorexia

Survey Completion 0% 100%

>>

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Survey Powered By [Qualtrics](#)

Figure 1: A screenshot of the first page of the EOL online module “Life, Death, and Medicine: The Dying Process, Terminal Care and Hospice Care” is displayed. It includes two quotations to set the tone for the module, followed by why students should learn about end of life care and palliative care. The three learning objectives are displayed.

Figure 2: Online Module Case Study #1: The Dying Process

Life, Death, & Medicine: The Dying Process, Hospice Care, and Terminal Care

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Part 1: The Dying Process

Case Study 1: Mrs. Chin - End-stage COPD

Mrs. Chin is an 87-year old Asian female with end-stage Chronic Obstructive Pulmonary Disease (COPD). In the past week, she became less arousable, sleeping most of the time. Her appetite decreased, and she consumes only 5-10% portion of her food and drink at each meal. She appears to pick aimlessly at her bed sheets and have conversations with her deceased husband. She is able to tell you her name, age, and location, but says the date is July 1978.

Vital Signs: T = 98, BP = 118/78, HR = 107, RR = 20, Pain = 4/10

On physical exam, she has tachycardia, distant heart sounds, diminished bowel sounds, and appropriate capillary refill time (<2s). You notice that she breathes irregularly and uses her accessory muscles. Her skin is thin with tenting, and lentigo senilis appears on arms and legs.

Which symptoms of the dying process did Mrs. Chin exhibit? (check all that apply)

- Bed bound
- Fever
- Cool Extremities
- Loss of interest in eating or drinking
- Obtundation
- Mottling
- Increased sleepiness
- Death rattle
- Altered respiratory pattern
- Near death awareness/delirium

Survey Completion: 0% to 100%

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Survey Powered By Qualtrics

Figure 2: A screenshot of the first page of Case Study #1, a patient with end-stage chronic obstructive pulmonary disease, to illustrate the three stages of the dying process. A multiple choice question with more than one right answer is used as an interactive feature to engage the learner.

Figure 3: Online Module's Video Clip on Cheyne-Stokes Breathing

Life, Death, & Medicine: The Dying Process, Hospice Care, and Terminal Care

Yale University

Over the next two days, Mrs. Chin's condition continues to decline. Her daughters tell you that they were glad to have come a few days earlier when Mrs. Chin was more alert and communicative. Now, Mrs. Chin is unarousable and appears to be asleep all the time. Her hands and feet are cold. Violaceous blotches appear on both of her knees.

Physical exam: T = 101.8; BP = 67/42; RR = 14, irregular; HR = 120, Pain = ? (unable to elicit response from patient)


Mrs. Chin's daughters tell you that their mother now breathes in a "funny pattern" which they describe as **cycles of long drawn out breaths, a normal breath, and short shallow breaths**. Occasionally, they do not hear any breathing at all for a few seconds. They ask you, "Is this normal?"

Yes

No

Video: Cheyne-Stokes breathing description and demonstration

The Dying Process - Cheyne-Stokes breathing.wmv



This video is shared with permission of the owner.

Survey Completion 0% 100%

<< >>

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Survey Powered By [Qualtrics](#)

Figure 3: A screenshot of one of the pages in Case Study #1 that includes an embedded video clip that demonstrates Cheyne-Stokes breathing.

Figure 4: Online Module Multiple Choice Question's Individualized, Real-Time Feedback

Life, Death, & Medicine: The Dying Process, Hospice Care, and Terminal Care

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Case Study: Mr. Lopez - End Stage Renal Disease (ESRD)

Mr. Lopez is a 54-year old Cuban American male with a long of uncontrolled type 2 diabetes mellitus who has end stage renal disease (ESRD). He has had dialysis for the past 6 months, but he expressed dissatisfaction. He is unhappy with the low quality of life from repeated infections, hospital admissions, bleeding episodes, and other complications from dialysis. He wants to stop dialysis. Mr. Lopez is uncertain about the life ahead. His family notices that some physical and mood changes in Mr. Lopez due to his anxiety.

Which of these symptoms is NOT a typical psychological expression of anxiety? (Select ONE)

Insomnia
 Irritability
 Poor coping skills
 Distractibility
 Disorientation

Correct - Disorientation is associated with delirium, rather than anxiety. Anxious patients do not lose awareness of self or environment.

In addition, physical manifestations of anxiety includes:

- Anorexia
- Nausea
- Hyperventilation
- Palpitation
- Sweating

Figure 4: This a screenshot of one of the multiple choice questions in the online module. At the top is the question and answer options. The bottom shows the text that appears if the answer option “Disorientation” (correct answer) was chosen. This is an interactive feature that provides individualized feedback for each answer option.

ASSESSMENT

An assessment of the educational effectiveness of the EOL online module was performed using a 23 item quiz/survey with 10 attitude-assessing statements, 8 knowledge-assessing multiple choice questions, 4 demographic questions, and one free-text box for comments.

Attitude survey

Ten statements were adapted from the Frommelt Attitude Toward Care of the Dying (FATCOD), a validated instrument with 30 Likert-type statements used to assess attitudes towards dying patients (Frommelt 1991, 37-43). We selected 10 of the statements (**Table 1**) to assess the students' self-perceived comfort level (statements 1-4), their views on the physician's responsibility (statements 5-7), and their perspective on the role of medical education (statements 9 and 10) in the care of dying patients. The students indicated their level of agreement or disagreement to each statement on a sliding scale of 0-100 (0 = completely disagree, 100 = completely agree). **Figure 5** displays a subset of the attitude-assessing statements as it appears in the survey.

Table 1: Attitude-assessing Statements Presented in the Questionnaire	
1.	I would feel uneasy if I entered the hospital room of a terminally ill patient.
2.	I feel comfortable talking to patients about death and dying.
3.	I feel prepared to care for patients at the end of life.
4.	I would feel uneasy if I ever had to care for patients with terminal disease.
5.	Physicians have a duty to care for dying patients.
6.	Doctors should avoid talking to patients about death-related issues.
7.	There's little that doctors can do for patients when they are dying.
8.	All possible efforts should be made to keep a terminally ill patient alive.
9.	Medical students should learn about death and dying.
10.	Learning about death and dying in medical school is not as important as learning to cure and treat diseases.

Presented in Table 1 are the ten individual attitude statements in our survey that were adapted from the FATCOD survey (Frommelt 1991, 37-43).

Figure 5: Attitudes- Assessing Survey Sample

On the scale, mark the position which best reflects your opinion:

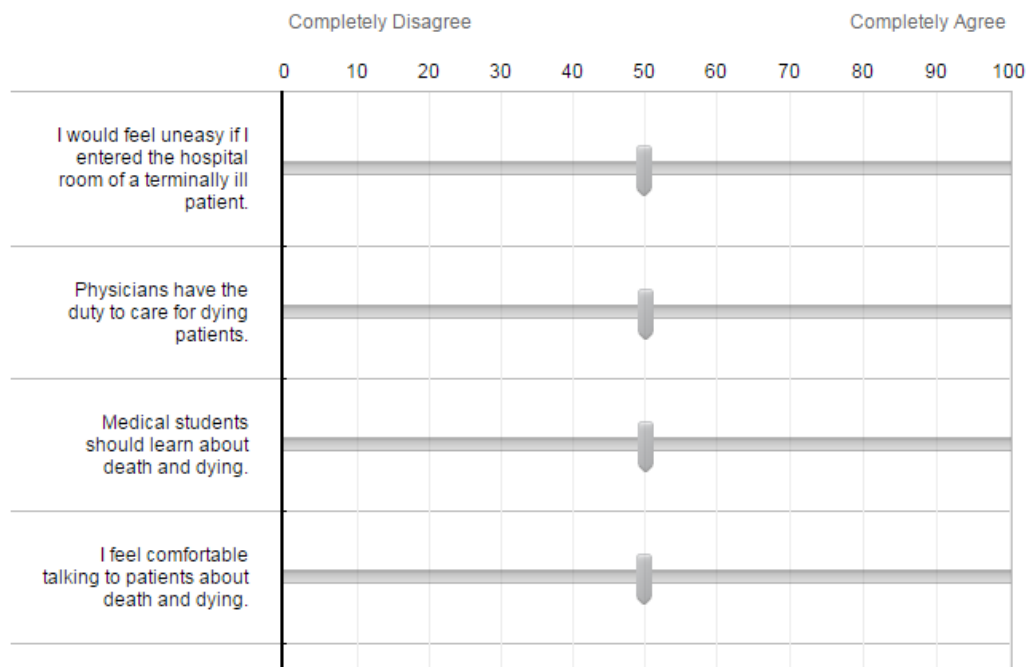


Figure 5: Four of ten attitudes-assessing statements are displayed. To the right of each statement is a sliding scale in which students slide the anchor to indicate their degree of agreement with the statement from 0-100 (0 = completely disagree, 100 = completely agree).

Knowledge quiz

Table 2 shows the eight multiple choice questions used to assess the students' knowledge. The questions assessed the students' knowledge about the dying process,

terminal symptoms and their management/treatment, and hospice care. Each question had one best answer out of four possible choices. The quiz questions were reflective of the content in the online module though not the same as the learning questions within the module that were used as an interactive feature to engage the learner.

Table 2: Knowledge-assessing Multiple Choice Questions in the Quiz	
1.	<p>Mr. Kammel is an 87-year old man who was diagnosed with end-stage multiple myeloma and was admitted to hospice care three months ago. Today, on your visit Mr. Kammel, you note that he has a fever of 101.8° F, his breathing is irregular, his hands and feet are cold, and there is mottling (blotchy red-blue skin) bilaterally on his knees and feet. Based on these findings, Mr. Kammel is in which stage of active dying?</p> <ul style="list-style-type: none"> <input type="checkbox"/> Pre-dying stage <input type="checkbox"/> Early stage <input type="checkbox"/> Mid stage <input type="checkbox"/> Late stage
2.	<p>The "death rattle" is a sound produced by the accumulation of saliva in the throat and can be a manifestation of someone who is near death. The best medication to treat the death rattle is a/an:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Anti-cholinergic agent(e.g., scopolamine) <input type="checkbox"/> Benzodiazepine (e.g, lorazepam) <input type="checkbox"/> Opioid analgesic (e.g., morphine) <input type="checkbox"/> Local airway anesthetic (e.g., inhaled lidocaine)

3.	<p>In a patient with advanced pulmonary fibrosis who is on maximal medical management, which of the following is the best first-line medication to palliate the sensation of terminal dyspnea?</p> <ul style="list-style-type: none"><input type="checkbox"/> Acetaminophen (aniline analgesic)<input type="checkbox"/> Haloperidol (typical anti-psychotic)<input type="checkbox"/> Morphine (opioid)<input type="checkbox"/> Diazepam (benzodiazepine)
4.	<p>Your patient Mr. Guzman is terminally ill. He is bed bound, increasingly sleepy, and has a drastically decreased appetite. Which of the following action(s) are appropriate regarding his feeding?</p> <ul style="list-style-type: none"><input type="checkbox"/> Instruct the caregiver to force feed Mr. Guzman if he eats <30% of his meals.<input type="checkbox"/> Insert a feeding tube to supply enteral nutrition if Mr. Guzman chooses to stop eating or drinking orally.<input type="checkbox"/> Continue serving meals to Mr. Guzman, but allow Mr. Guzman to eat less or refuse the food.<input type="checkbox"/> Tell Mr. Guzman's family that anorexia is painful and you will reverse it by immediately by administrating appetite stimulants.
5.	<p>Anxiety at the end-of-life is not uncommon, as the patient is likely to face many life changes resulting directly or indirectly from their disease condition. Which of the following is NOT a typical manifestation of end-of-life anxiety?</p> <ul style="list-style-type: none"><input type="checkbox"/> Insomnia<input type="checkbox"/> Distractibility

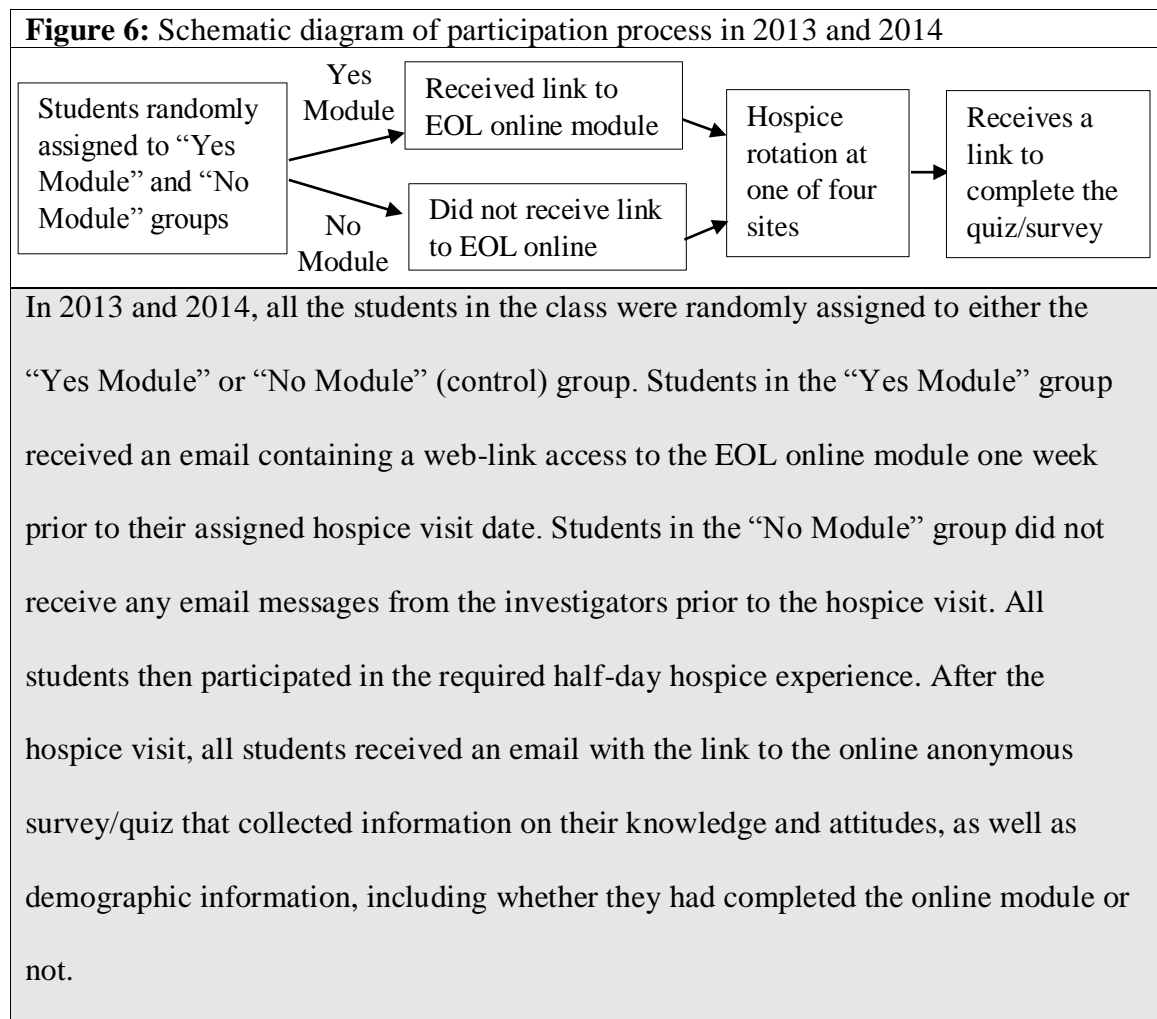
	<input type="checkbox"/> Irritability <input type="checkbox"/> Disorientation
6.	<p>Following the death of a patient with chronic illness, which of the following may be the LEAST helpful phrase to say to the surviving loved ones?</p> <input type="checkbox"/> "I am very sorry for your loss." <input type="checkbox"/> "He's in God's hands now." <input type="checkbox"/> "This must be hard for you." <input type="checkbox"/> "People really cared for him."
7.	<p>Which of the following is NOT a Medicare Hospice Benefit admission criteria?</p> <input type="checkbox"/> Certification of terminal illness and prognosis by two physicians <input type="checkbox"/> DNR (do not resuscitate) status <input type="checkbox"/> Life expectancy of 6 months or less <input type="checkbox"/> Change the approach of care from cure to palliative and symptom-management
8.	<p>Hospice specializes in caring for patients near the end of life. Which of the following is NOT a required hospice service legislated by the Medicare Benefit Act?</p> <input type="checkbox"/> Night-time custodial care <input type="checkbox"/> Payment for all medications and medical equipment related to the terminal illness <input type="checkbox"/> Bereavement program for surviving families <input type="checkbox"/> Chaplaincy support

Table 2: The knowledge-assessing quiz contains eight multiple choice questions that tests the students' knowledge towards EOL care in three domains: the dying process (question 1), terminal symptoms and their management/treatment (questions 2-5), and hospice care (questions 7-8).

DATA COLLECTION

In the fall semesters of 2012, 2013, and 2014, the second-year medical students at the Yale School of Medicine were invited to voluntarily participate in this study. In the pilot year (2012), all the second-year students were sent an invitation email that contained a web-link to this EOL online module for voluntary completion of the module. The EOL module invitations were sent in batches of 16-17 messages corresponding to the group of students who were to participate in a required hospice experience in the upcoming week. The required hospice visit component (led by Dr. Matthew Ellman) was part of the Pre-Clinical Clerkship course (led by Dr. Margaret Bia and Dr. Jaideep Talwalker) and took place between late-September and early-November at one of four sites: Connecticut Hospice, Middlesex Hospital, Yale-New Haven Hospital, and St. Raphael's Hospital. Students were divided into groups of two to four and spent an afternoon with a palliative care doctor visiting hospice patients, followed by a debriefing discussion and written reflection activity. On the evening after students completed their hospice experience, they received a second email that contained an invitation link to the survey/quiz link. At the end of four weeks, once all the students completed their hospice visits, a third email was sent to all the students inviting them to complete the quiz/survey. During the pilot year (2012), we empirically obtained the participation rate by inviting all students to complete

the EOL online module and the survey/quiz then determined how many students actually completed each component. In subsequent years (2013 and 2014), 70% of the students were randomized to receive access to the EOL online module via email one week prior to their hospice experience, while 30% were randomized to the control group that did not receive access to the EOL online module prior to their hospice experience. All students received an invitation to complete the post-hospice experience survey/quiz. The class list, email addresses, hospice site assignment, and rotation dates were obtained from Dr. Bia. A schematic diagram depicting the flow of the randomized study is shown in **Figure 6**.



Participation in the study was voluntary, and students who chose not to participate were not penalized in anyway. Students completed the survey anonymously: Qualtrics© assigned a computer generated code to each respondent that masks the identity of the students; responses could not be traced back to individual students. Institutional Review Board (IRB) exemption for this study was granted by the Yale University Human Subjects Committee on September 25th, 2012 under 45 CFT 46.101(b)(1).

DATA ANALYSIS

For data organization and statistical analysis, Microsoft Excel and IBM SPSS version 22.0 were utilized. The students' answers on the knowledge quiz were coded as 1 (correct) or 0 (incorrect). The total number of correct answers were tallied for each student and for each question. Multinomial logistic regression was performed to determine whether there was statistical significance in the performance of the students based on their gender, cohort year (class), location of hospice rotation, and completion of the EOL online module. A p-value of $p < .05$ was deemed as statistically significant. For the attitudes survey, multivariate ANOVA was used to determine whether the degree of agreement or disagreement to the attitudes statements were statistically different based on the same independent variables listed above for the knowledge quiz analysis. The scores were inversed (subtracted by 100) for statements that were presented with negative wording (e.g., "I feel uncomfortable...") to indicate the level of agreement to the theme (positively worded). **Table 3** summarizes the statistical analyses performed on the results.

The steps to perform multinomial logistic regression on knowledge quiz on IBM SPSS version 22.0 were as follows: “Analyze” → “Regression” → “Multinomial Logistic Regression”.

Table 3: Summary of statistical analyses performed on the quiz/survey results			
	Statistical test	Dependent variable	Independent variables
Knowledge quiz	Multinomial logistic regression	Correct or incorrect answer. Four answer options for each MCQ (includes one best answer). Eight MCQ's in the quiz.	<ul style="list-style-type: none"> • Gender (male or female) • Cohort year (2012, 2013, 2014) • Location of hospice rotation (Yale-New Haven Hospital, Middlesex Hospital, Connecticut Hospice, and St. Raphael's Hospital) • Completion of the EOL online module (yes or no)
Attitudes questionnaire	Multivariate ANOVA	Degree of agreement on a scale of 0 to 100 (0 = completely disagree, 100 = completely agree)	

Internal validity of quiz

For internal consistency reliability analysis, the Cronbach's alpha (α) was calculated.

This is to determine the validity of the quiz/survey by measuring the correlation between thematically related items (Tavakol and Dennick 2011, 53). For example, there would be high internal consistency if respondents expressed agreement between the statements “I

would feel uneasy if I ever had to care for patients with terminal disease” and “I would feel uneasy if I entered the hospital room of a terminally ill patient” while disagreeing with “I feel prepared to care for patients at the end of life”. To run the analysis, the scores for negatively worded statements were reversed (i.e., subtracted by 100) to make them comparable with positively worded statements.

On IBM SPSS version 22.0, Cronbach’s alpha was calculated using the following steps:

“Analyze” → “Scale” → “Reliability Analysis” → Model: “Alpha”. The output, Cronbach’s alpha (α), ranged from negative infinity to positive one, with acceptable values for α in the range of 0.70 to 0.95 (Tavakol and Dennick 2011, 53).

RESULTS

Participants

A total of 152 students participated in this study from September 2012 to November 2014 (**Table 4 and 5**). The overall response rate was 51% (300 invitations sent). Between the three class cohorts, 62 students (40%) participated in 2012; 66 (43%) in 2013, and 24 (16%) in 2014. Of all the respondents, 56 students (37%) had completed the module and 85 (56%) had not; 11 students (7%) did not indicate whether they had completed the module or not. The gender distribution in 2013 and 2014 was 43 (48%) females and 47 (52%) males; the gender of the participants in 2012 was not recorded. Four hospice visit sites were assigned in 2012: Connecticut (CT) Hospice, Middlesex Hospital, Yale-New Haven Hospital Palliative Care Service, and St. Raphael's Hospital Palliative Care Service. In 2013 and 2014, only two hospice rotation sites were offered: CT Hospice and Middlesex Hospital. Overall, 61 (51%) students rotated through CT Hospice, 58 (28%) Middlesex Hospital, 11 (8%) Yale-New Haven Hospital, and 8 (5%) St. Raphael's hospital. 14 students (9%) did not indicate their hospice sites.

Table 4: Participant demographics				
	2012	2013	2014	Total
Gender:				
Female	/	29	14	43
Male	/	37	10	47
Hospice rotation locations:				
CT Hospice	13	37	11	61
Middlesex Hospital	19	27	12	58

Yale-New Haven Hospital	11	0	0	11
St. Raphael's Hospital	8	0	0	8
Unknown	11	2	1	14

Table 4: Participant demographics. Forty-three participants were female; 47 were male. Of the two (2013 and 2014) to four (2012) hospice rotation locations, 61 students were at CT Hospice, 58 at Middlesex Hospital, 11 at Yale-New Haven Hospital, and 8 at St. Raphael's Hospital. Fourteen students did not indicate the location of their hospice rotation.

Table 5: Participant Distribution				
	2012	2013	2014	Total
Total number of invitations	100	100	100	300
Number of students who completed the survey/quiz	62	66	24	152
“Yes Module”	34	11	11	56
“No Module”	28	44	13	85
Unknown	0	11	0	11

Table 5: Participant distribution. A total of 300 invitations were sent to the second-year class in 2012, 2013, and 2014. The number of completed surveys were 152; 62 in 2012, 66 in 2013, and 24 in 2014. Fifty-six completed the EOL online module, 85 had not; 11 did not indicate it.

Knowledge

Multinomial logistic regression was used to determine whether the participants' performance on the knowledge quiz (based on individual question scores and the quiz total) were dependent on whether they had completed the EOL online module, as well as their class cohort, gender, and hospice rotation location (**Table 6**). Statistical analyses show that only completion of the EOL online module improved the students' overall quiz performance ($p=0.006$), whereas there were no significant differences between gender ($p=0.730$), hospice rotation location ($p=0.381$), or class cohort ($p=0.377$). With regards to the performance on each of the eight multiple choice questions, completion of the module was correlated with better performance ($p<0.002$) on five out of eight questions (questions 2 and 5-8) in the domains of hospice eligibility and provisions and treatment of terminal symptoms, as well as on the test overall ($p=0.006$). The class cohort was correlated with the results ($p = 0.041$) of only one of the questions (question 2).

Table 7 shows the detailed results of the knowledge quiz, with the number and percentage of students who chose each answer option based on whether they did or did not completed the EOL online module for each year of the study.

Table 6: Knowledge Quiz Results Summary

	Question Topic	Hospice benefit	Hospice admission	Communication	Anxiety (Sx)	Anorexia (non-Rx)	Dyspnea (Rx)	Death rattle (Rx)	Stages of actively dying	Total Quiz Avg
Yes Module (% correct)	2012	61	86	96	68	96	42	71	57	72
	2013	77	98	95	73	98	59	84	39	78
	2014	46	85	85	69	92	77	54	25	66
	Avg	61	90	92	70	95	59	70	40	72
No Module (% correct)	2012	29	47	55	50	76	55	42	21	47
	2013	18	82	55	45	100	73	55	45	59
	2014	27	64	64	27	91	82	36	55	56
	Avg	25	64	58	41	89	70	44	40	54
<i>p-value</i>	Module	0.000	0.000	0.000	0.000	0.157	0.513	0.002	0.579	0.006
	Location	0.171	0.634	0.439	0.758	0.626	0.625	0.196	0.265	0.381
	Year	0.209	0.122	0.618	0.699	0.322	0.079	0.041	0.979	0.377
	Gender	0.069	0.337	0.762	0.091	0.863	0.131	0.511	0.137	0.73

Table 6: Knowledge quiz results summary presented as the percentage of correct answers for each question. "Rx" represents pharmacological and "Sx" represents symptoms. The p-value for the variables yes/no module, hospice rotation location, year, and gender for each question are shown at the bottom; statistically significant values (p<.05) are in bold.

Table 7: Knowledge quiz results									
	Yes Module n(%)				No Module n(%)				
	2012	2013	2014	All	2012	2013	2014	All	
Class Cohort (Year)	2012	2013	2014	All	2012	2013	2014	All	
<i>I. Mr. Kammel is in which stage of active dying?</i>									
<input type="checkbox"/> Pre-dying stage	1(4)	3(7)	0(0)	4(2)	1(3)	0(0)	1(9)	2(4)	
<input type="checkbox"/> Early stage	2(7)	10(23)	5(42)	17(24)	7(21)	2(18)	1(9)	10(16)	
<input type="checkbox"/> Mid stage	9(32)	14(32)	4(33)	27(32)	19(56)	4(36)	3(27)	26(40)	
<input type="checkbox"/> Late stage	16(57)	17(39)	3(25)	36(40)	7(21)	5(45)	6(55)	18(40)	
<i>2. Treat the "death rattle" with:</i>									
<input type="checkbox"/> Anti-cholinergic agent (e.g., scopolamine)	20(71)	37(84)	7(54)	64(70)	14(42)	6(55)	4(36)	24(44)	
<input type="checkbox"/> Benzodiazepine (e.g., lorazepam)	3(11)	2(5)	2(15)	7(10)	6(18)	2(18)	2(18)	10(18)	
<input type="checkbox"/> Opioid analgesic (e.g., morphine)	3(11)	3(7)	1(8)	7(9)	7(21)	2(18)	3(27)	12(22)	
<input type="checkbox"/> Local airway anesthetic (e.g., inhaled lidocaine)	2(7)	2(5)	3(23)	7(12)	6(18)	3(27)	2(18)	11(21)	

Table 7: Knowledge quiz results - continued							
Class Cohort (Year)	Yes Module n(%)			No Module n(%)			All
	2012	2013	2014	2012	2013	2014	
3. Palliate the sensation of terminal dyspnea with							
<input type="checkbox"/> Acetaminophen (aniline analgesic)	1(1)	2(7)	0(0)	0(0)	1(3)	0(0)	1(1)
<input type="checkbox"/> Haloperidol (typical anti-psychotic)	8(10)	3(11)	0(0)	0(0)	7(21)	1(9)	8(10)
<input type="checkbox"/> Morphine (opioid)	25(70)	12(42)	26(59)	10(77)	18(55)	9(82)	25(70)
<input type="checkbox"/> Diazepam (benzodiazepine)	11(19)	11(39)	18(41)	3(23)	7(21)	1(9)	11(19)
4. Manage terminal anorexia by:							
<input type="checkbox"/> Force feed the patient	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
<input type="checkbox"/> Insert a feeding tube	0(0)	1(2)	0(0)	1(1)	0(0)	1(9)	6(8)
<input type="checkbox"/> Continue serving meals	27(96)	42(98)	12(92)	91(95)	11(100)	10(91)	47(89)
<input type="checkbox"/> Administer appetite stimulants	1(4)	0(0)	1(8)	2(4)	0(0)	0(0)	3(3)

Table 7: Knowledge quiz results - continued									
	Yes Module n(%)				No Module n(%)				
	2012	2013	2014	All	2012	2013	2014	All	
Class Cohort (Year)									
5. End-of-life anxiety does NOT manifest as:									
<input type="checkbox"/> Insomnia	1(1)	2(7)	0(0)	0(0)	2(2)	1(3)	0(0)	1(1)	
<input type="checkbox"/> Distractibility	8(10)	3(11)	0(0)	0(0)	3(4)	7(21)	1(9)	8(10)	
<input type="checkbox"/> Irritability	25(70)	12(42)	26(59)	10(77)	48(59)	18(55)	9(82)	25(70)	
<input type="checkbox"/> Disorientation	11(19)	11(39)	18(41)	3(23)	32(34)	7(21)	1(9)	11(19)	
6. The LEAST appropriate comment after the death of a patient is:									
<input type="checkbox"/> "I am very sorry for your loss."	0(0)	0(0)	0(0)	0(0)	2(6)	1(9)	1(9)	4(8)	
<input type="checkbox"/> "He's in God's hands now."	27(96)	42(95)	11(85)	80(92)	22(55)	6(55)	7(64)	35(58)	
<input type="checkbox"/> "This must be hard for you."	1(4)	2(5)	2(15)	5(10)	6(18)	2(18)	2(18)	10(18)	
<input type="checkbox"/> "People really cared for him."	0(0)	0(0)	0(0)	0(0)	4(12)	2(18)	1(9)	7(13)	

Table 7: Knowledge quiz results - continued									
Class Cohort (Year)	Yes Module n(%)				No Module n(%)				All
	2012	2013	2014	All	2012	2013	2014	All	
7. The Medicare Hospice Benefit admission criteria does NOT include:									
<input type="checkbox"/> Certification by two physicians	1(4)	1(2)	0(0)	2(2)	10(29)	2(18)	1(9)	13(19)	
<input type="checkbox"/> DNR status	24(86)	43(98)	11(85)	78(90)	16(47)	9(82)	7(64)	32(64)	
<input type="checkbox"/> Life expectancy of 6 months or less	0(0)	0(0)	0(0)	0(0)	2(6)	0(0)	1(9)	3(5)	
<input type="checkbox"/> Change the approach of care from cure to palliative and	3(11)	0(0)	2(15)	5(9)	6(18)	0(0)	2(18)	8(12)	
8. The Medicare Benefit Act does NOT provide:									
<input type="checkbox"/> Night-time custodial care	17(61)	34(77)	6(46)	57(61)	10(29)	2(18)	3(27)	15(25)	
<input type="checkbox"/> Payment for all medications and medical equipment	5(18)	3(7)	5(38)	13(21)	13(38)	3(27)	3(27)	19(31)	
<input type="checkbox"/> Bereavement program	4(14)	5(11)	0(0)	9(8)	7(21)	3(27)	2(18)	12(22)	
<input type="checkbox"/> Chaplaincy support	2(7)	2(5)	2(15)	6(9)	4(12)	3(27)	3(27)	10(22)	

Table 7: The knowledge quiz results are presented as the number (n) and percentage (%) for each answer option for each of the eight knowledge-assessing multiple choice questions. The correct answer is in bold.

Question #1 tests knowledge about the stages of the active dying process. The students were presented with a patient scenario and were asked to identify whether a patient was in the early stage, mid stage, or late stage of the active dying process. A fourth option, “pre-dying stage”, was given as an incorrect answer. Around 40% of the students correctly identified the late stage of dying based on the signs of skin mottling, cold extremities, and irregular breathing pattern. Only a few students incorrectly identified “pre-dying” as one of the stages of the active dying process. 97% of students recognized that the active dying process is comprised of the early-, mid-, and late- stages, but most students had difficulty distinguishing the stages, especially the mid-stage (37%) and late-stage (40%), based on symptoms presentation. The students’ performance were not statistically significant between those who had completed the EOL online module and those who had not.

The students’ knowledge on the management of selected terminal symptoms were assessed with three multiple choice questions (questions #2-4), two of which related to pharmacological treatments (for the “death rattle” and dyspnea) and one to a non-pharmacological intervention (for anorexia). There was statistically significant improvement in one of these three questions (the death rattle) with the completion of the EOL online module and also the cohort year. A majority (n=64, 70%) of the students who completed the module correctly identified anti-cholinergic agent (such as scopolamine) as a pharmacological treatment for the death rattle; whereas, those who did not complete the

module had half as many correct answers ($n=21$, 35%), and the difference was statistically significant ($p=0.002$). Unexpectedly, the performance of the students were found to be statistically different between the cohort years ($p=0.041$). This was the only question on the quiz where statistical difference was found between different classes. The distribution between the three incorrect answer options were similar within the Yes Module group ($n=7$, 10% for benzodiazepine; $n=7$, 9% for opioid analgesic; and $n=7$, 12% for local airway anesthetic) and No Module group ($n=10$, 18% for benzodiazepine; $n=12$, 22% for opioid analgesic; and $n=11$, 21% for local airway anesthetic).

Question #3 asked students to identify a pharmacological agent that could palliate the sensation of terminal dyspnea. Students who did not complete the module had more correct answers ($n=25$, 70%) than those who completed the module ($n=48$, 59%); however, it was not statistically different ($p=0.513$). There also appeared to be a trend of improving performance with each subsequent year in both the Yes Module group (42%, 59%, 77% correct in 2012, 2013, 2014 respectively) and No Module group (55%, 73%, 82% correct in 2012, 2013, 2014 respectively); though, again, the effects of the class year were not statistically significant ($p=0.079$). A portion of the students ($n=32$, 34% in Yes Module group and $n=11$, 19% in No Module group) thought that diazepam, a benzodiazepine, could help with terminal dyspnea, and this was the second most common answer. A minority of students ($n=3$, 4% in Yes Module group and $n=8$, 10% in No Module group) incorrectly chose haloperidol, a typical antipsychotic medication as the treatment for terminal dyspnea; and most of these mistakes were made by the students in 2012. Only four students (2%) in the entire sample incorrectly selected acetaminophen as a treatment for terminal dyspnea.

Lastly, a third question asked about the management of terminal anorexia.

Pharmacological and non-pharmacological options were given. The vast majority of students in both the Yes Module group (n=91, 95%) and No Module group (n=47, 89%) correctly identified the proper management of an anorexic terminal patient by continuing to offer meals but allowing the patient to eat less or refuse the food. Reassuringly, none of the students opted to force feed the patient. A small number of students (n=2, 8% in Yes Module group and n=3, 3% in No Module group) chose a pharmacological option (administer appetite stimulants) to ameliorate anorexia, and another small portion of students (n=1, 1% in the Yes Module group and n=6, 8% in the No Module group) chose to start parenteral nutrition by inserting a feeding tube.

Another question asked about the manifestation of a common terminal symptom, anxiety. Students were asked to choose among four options (insomnia, distractibility, irritability, and disorientation) which sign or symptom was not a characteristic manifestation of anxiety (disorientation). Students who completed the EOL online module were statistically more likely (p=0.000) to choose the correct answer (n=60, 70%) compared to those who did not complete the module (n=25, 41%). Among the incorrect answers, “distractibility” was most commonly chosen in both the Yes Module group (n=15, 15%) and No Module group (n=16, 28%). Most students believed that “irritability” is a manifestation of anxiety, thus the fewest number of people (n=3, 3% in Yes Module group and n=5, 9% in No Module group) chose this sign as non-representative of anxiety.

With regards to demonstrating cultural and spiritual sensitivity and communication skills, one of the quiz questions (#6) asked students which phrase is the least appropriate to say to the family members of a patient who recently passed away. Those who completed the

EOL online module seemed to be more aware of this. In fact, 92% (n=80) in the Yes Module group chose the phrase with a religious connotation (“He is in God’s hands now”) as the least appropriate to say to the family of a recently diseased patient when compared to non-religious phrases (“I am very sorry for your loss”, “This must be hard for you”, and “People really cared for him”) compared to only 58% (n=35) in the No Module group (p=0.000). No one in the Yes Module group thought that “I am very sorry for your loss” or “people really cared for him” were inappropriate to say; whereas, some students (n=4, 8% and n=7, 13%, respectively) in the No Module group thought so. A minority of students in both the Yes Module group (n=5, 10%) and No Module group (n=10, 18%) thought that “this must be hard for you” was the most inappropriate phrase out of the four options.

Questions #7 and #8 addressed hospice eligibility and benefits. Question #7 asked students to identify the criterion that is *not* required for hospice admission as outlined in the Hospice Benefit Act (Medicare Part A). 90% (n=70) of the students who completed the EOL online module correctly identified “DNR status” as not necessary for enrollment into hospice; whereas, only 64% (n=24) of those who did not complete the module answered this correctly. The performance between the Yes Module and No Module groups was statistically significant (p=0.000). One-fifth of the students (n=13, 19%) who did not complete the module did not realize that the enrollment criteria involves certification of the patient’s prognosis by two physicians; whereas, only 2% (n=2) of those who did complete the module made this mistake. Enrolling into hospice involves changing the approach of care from curative to palliative (including symptoms management), but about one in ten students did not realize this (n=5, 9% in the Yes

Module group and n=8, 12% in No Module group). All those in the Yes Module group recognized that enrollment in hospice involve patients with life expectancy of six months or less, but 5% (n=3) in the No Module group failed to do so.

Question #8 asked students which of the options presented is *not* a hospice service or benefit outlined in the Medicare Hospice Act. The majority of students who completed the module (n=57, 61%) correctly identified night-time custodial care as a service not included in the Medicare Hospice Act; whereas, only a quarter (n=15, 25%) in the No Module group recognized this. This difference in the number of correct answers was statistically significant (p=0.000). Most commonly, those in the No Module group (n=19, 31%) did not realize that Medicare covers the payment for all medications and medical equipment related to a terminal illness. Within the Yes Module and No Module group, similar proportions of students thought that “chaplaincy support” for patients and “bereavement programs” for families were not covered by the Medicare Hospice Benefit (n=9, 8% and n=6, 9% respectively in the Yes Module group and n=12, 10% and n=10, 22% respectively in the No Module group).

Attitudes

The students indicated their degree of agreement to each statement on a scale of 0 (completely disagree) to 100 (completely agree). The students’ expressed a full range of response, ranging from the lowest possible score (0) to the highest (100). **Figure 7** displays the students’ responses according to by Yes Module verses No Module group and cohort year. There was a high degree of agreement with the four statements

pertaining to professional responsibility (displayed in **Figure 7** with solid red/orange/yellow bars). Students expressed >80% agreement that physicians have a duty to care for dying patients, that doctors should talk to patients about death and dying, and that doctors have a significant role in the care of patients at the end of life. The students had moderate degrees of personal discomfort towards end of life care (**Figure 7**, blue dashed lines). Their level of comfort ranged from 30-75% regarding being in the presence of, speaking with, or providing care to patients at the end of life. Students generally agreed (average 97% agreement, SD=6) that end-of-life education is an important part of medical school, though there was stronger agreement towards the inclusion it in the curriculum than its relative importance to other topics focused on treating/curing diseases (average 70% agreement, SD=25, that education on EOL care is just as important as other topics). One statement assessed the students' view on medical intervention at the end of life ("All possible efforts should be made to keep a terminally ill patient alive."). To this, the students expressed the lowest degree of agreement (15-40%) compared to all the other statements.

The students' responses were compared based on whether they had completed the module (**Table 8** for combined results; **Table 9 & 10** for Yes and No Modules, respectively), their hospice rotation location, cohort year, and gender. No statistically significant differences ($p < 0.05$) were found in any of these four categories (see **Tables 9 & 10**).

Figure 7: Attitudes to End-of-Life Care

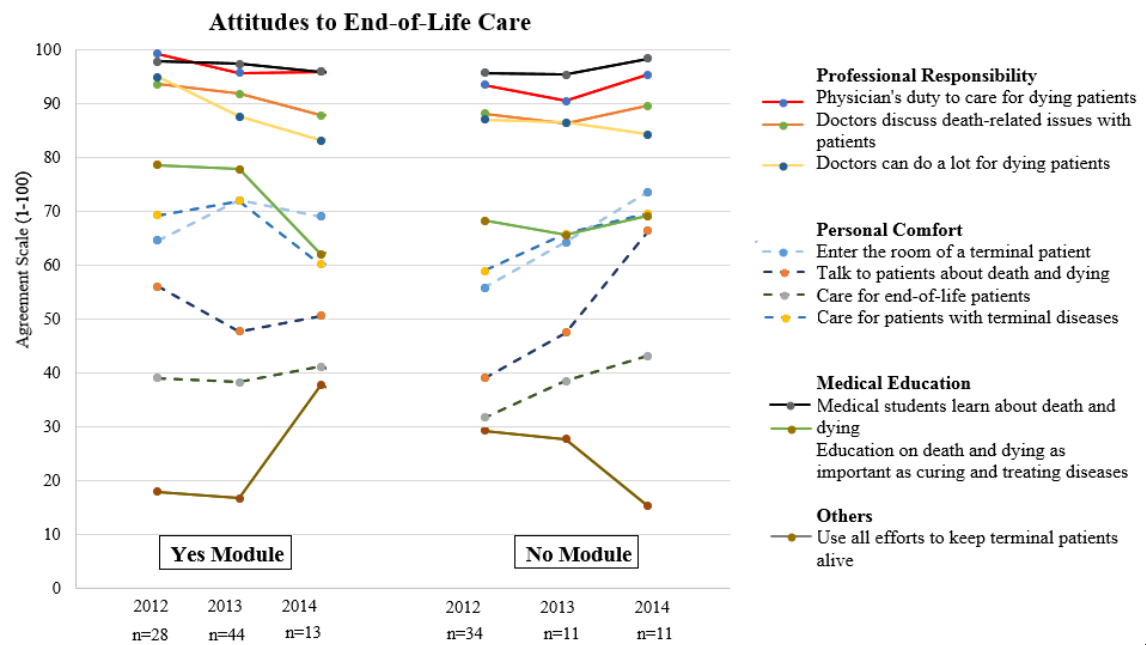


Figure 7: Attitudes to End-of-Life Care. Students expressed their degree of agreement on a scale from 0 (completely disagree) to 100 (completely agree) on various statements pertaining to personal responsibility, personal comfort, medical education, and others. The responses of students who completed the module (Yes Module) are on the left, and those of students who did not (No Module) are on the right. The responses are separated by their class cohort (years 2012, 2013, and 2014). Of note, the graph displays the degree of agreement towards a theme/concept; as such, the scores of negatively worded attitude statements have been inverted (subtracted by 100).

Table 8: Summary of the Attitude Results

Attitude Statements	Yes Module			No Module			All			p-value			
	Avg	SD	n	Avg	SD	n	Avg	SD	n	Module	Location	Year	Gender
1. I feel comfortable talking to patients about death and dying.	31	22	83	33	24	149	35	25	54	0.369	0.897	0.657	0.523
2. I feel prepared to care for patients at the end of life.	52	26	82	48	26	149	51	24	56	0.643	0.138	0.3	0.176
3. I would feel uneasy if I ever had to care for patients with terminal disease.	40	24	83	37	24	149	38	23	56	0.733	0.116	0.701	0.16
4. Physicians have a duty to care for dying patients.	33	23	81	33	24	145	35	25	56	0.237	0.813	0.5	0.064
5. Doctors should avoid talking to patients about death-related issues.	97	6	85	96	8	149	93	11	56	0.178	0.41	0.676	0.982
6. There's little that doctors can do for patients when they are dying.	9	10	74	10	13	134	12	17	53	0.477	0.4	0.499	0.837
7. All possible efforts should be made to keep a terminally ill patient alive.	11	18	78	13	19	142	14	18	56	0.247	0.373	0.847	0.333
8. Medical students should learn about death and dying.	24	17	79	23	19	141	24	22	54	0.352	0.677	0.95	0.139
9. Learning about death and dying in medical school is not as important as learning to cure and treat diseases.	97	6	85	97	7	149	97	9	56	0.401	0.742	0.236	0.762
10. Learning about death and dying in medical school is not as important as learning to cure and treat diseases.	27	27	81	27	25	145	32	25	56	0.736	0.74	0.215	0.072

Table 9: "Yes Module" Group Attitude Results Separated by Year

Attitude Statements	2012		2013		2014		All years		
	Avg	SD	n	Avg	SD	n	Avg	SD	n
1. I feel comfortable talking to patients about death and dying.	35	24	28	28	20	42	31	22	83
2. I feel prepared to care for patients at the end of life.	56	24	28	48	25	42	51	26	82
3. I would feel uneasy if I ever had to care for patients with terminal disease.	39	22	27	38	27	43	41	17	83
4. Physicians have a duty to care for dying patients.	31	23	26	28	23	42	40	23	81
5. Doctors should avoid talking to patients about death-related issues.	99	3	28	96	7	44	96	8	85
6. There's little that doctors can do for patients when they are dying.	6	11	19	8	9	42	12	12	74
7. All possible efforts should be made to keep a terminally ill patient alive.	5	9	22	12	22	43	17	16	78
8. Medical students should learn about death and dying.	18	18	24	17	14	43	38	14	79
9. Learning about death and dying in medical school is not as important as learning to cure and treat diseases.	98	6	28	97	5	44	96	9	85
10. Learning about death and dying in medical school is not as important as learning to cure and treat diseases.	21	28	25	22	25	43	38	28	81

Attitude Statements	2012			2013			2014			All years		
	Avg	SD	n	Avg	SD	n	Avg	SD	n	Avg	SD	n
1. I feel comfortable talking to patients about death and dying.	44	24	32	36	20	11	26	26	11	35	25	54
2. I feel prepared to care for patients at the end of life.	39	22	34	48	19	11	66	20	11	51	24	56
3. I would feel uneasy if I ever had to care for patients with terminal disease.	32	22	34	39	26	11	43	24	11	38	23	56
4. Physicians have a duty to care for dying patients.	41	26	34	34	22	11	30	25	11	35	25	56
5. Doctors should avoid talking to patients about death-related issues.	94	12	34	91	12	11	95	7	11	93	11	56
6. There's little that doctors can do for patients when they are dying.	12	19	32	14	17	11	10	13	10	12	17	53
7. All possible efforts should be made to keep a terminally ill patient alive.	13	20	34	13	20	11	16	10	11	14	18	56
8. Medical students should learn about death and dying.	29	23	34	28	20	11	15	18	9	24	22	54
9. Learning about death and dying in medical school is not as important as learning to cure and treat diseases.	96	10	34	95	9	11	98	4	11	97	9	56
10. Learning about death and dying in medical school is not as important as learning to cure and treat diseases.	32	28	34	34	23	11	31	16	11	32	25	56

Internal Consistency

Table 9 displays the internal consistency values (Cronbach's alpha) for the attitudes statements. For the students' self-perceived comfort towards end-of-life care (statements 1-4), the Cronbach's alpha result was $\alpha=0.737$, indicating high internal validity. For the students' perception on the doctor's responsibility in EOL care (statements 5-7), the result was $\alpha=0.515$, indicating poor validity. Similarly, the Cronbach's alpha for statements concerning the role of medical education was also low ($\alpha=0.305$).

Table 9: Internal consistency for attitudes statements

Theme	Statements	Cronbach's alpha
Personal comfort	A1*, A4*, A2, A3	0.737 – good
Doctor's duty	A5, A6*, A7*	0.515 – poor
Medical education	A9, A10*	0.305 – poor

Table 9: The ten attitudes statements were divided into themes (first column) and the Cronbach's alpha was calculated for each one (last column); the acceptable alpha value ($\alpha > 0.07$) is in bold. The middle column lists the attitude statements that were included in each theme; the asterisks (*) denotes value there were inversed (subtracted by one hundred) for calculation, which was done for all negatively worded statements.

For the knowledge quiz, the Cronbach's alpha calculated for the entire quiz was $\alpha=0.438$ (**Table 10**). For the questions that addressed the treatments for terminal symptoms (questions #2-4) and hospice-related questions (questions #7-8), the Cronbach's alpha was $\alpha=-0.051$ and $\alpha=0.438$, respectively. Since all the values were less than $\alpha = 0.5$ (Tavakol and Dennick 2011, 53), the knowledge quiz is considered to have low internal consistency.

Table 10: Internal consistency for knowledge questions

Theme	Statements	Cronbach's alpha
Managing terminal symptoms	K2, K3, K4	-0.051 – poor
Pharmacological Rx for terminal symptoms	K2, K3	-0.108 – poor
Hospice	K7&K8	0.435 – poor
All knowledge questions	K1-8	0.438 – poor

Table 10: The ten attitudes statements were divided into themes (first column) and the Cronbach's alpha was calculated for each one (last column). The middle column lists the knowledge questions that were included in each theme.

DISCUSSION

Study's Major Findings

Our newly developed “Life, Death, and Medicine: the Dying Process, Terminal Care, and Hospice Care” online module was shown to increase the knowledge of second-year medical students in the domains of hospice care and management of terminal symptoms. The students’ attitudes concerning their personal comfort with and the physician’s duty towards the care of terminally ill patients, and the perceived importance of EOL education in the curriculum did not seem to be affected by completion of the module. Indeed, the students expressed only moderate levels of comfort when dealing with dying patients even though they felt strongly that it is the physician’s duty to care for dying patients; perhaps, this discrepancy in the surveyed students’ need to serve and their perceived capacity is reflected in their acknowledgement of the importance of EOL education in medical curricula. These results were independent of the students’ gender, hospice visit location, and class cohort.

Importance of this Study's Findings

To our knowledge, this is the first reported end-of-life and palliative care educational program that targets hospice care education for second-year medical students. The EOL online module was shown to be effective in increasing the medical students’ knowledge about hospice care, particularly enrollment criteria and service provisions. Students who completed the EOL online module were more able to identify that hospice eligibility requires a prognosis of six months or less as certified by two physicians, and that

eligibility does not necessitate the patient having a DNR status. Students who completed the module were also more familiar with hospice benefits, such as provisions and payment for all medications and equipment related to treatment of terminal illness, chaplaincy support, and bereavement services. Students who completed the EOL online module were less likely to misidentify 24-hour custodial care as one of the hospice benefits. By increasing the knowledge of future physicians about hospice eligibility and services, perhaps it would help decrease the number of patients dying without the benefits of hospice care (Schockett et al. 2005, 400-407; Bradley et al. 2002, 305-311). This is demonstrated by the positive relationship between physicians' knowledge/comfort and hospice referral for terminally ill patients (Bradley et al. 2002, 305-311; Friedman, Harwood, and Shields 2002, 73-84).

Our study identified some specific areas of terminal and hospice care that students struggled with. Based on the results of the knowledge quiz, we found that students find it difficult to correctly identify the stages of dying based on the signs and symptoms. Perhaps, it is because symptoms are often interchangeable between stages, making it difficult to pinpoint the precise stage of active dying. It is possible that declaring that a patient as imminently dying is easier than knowing how close the patient is to death (early, mid, or late stage of the natural dying process). Moreover, it seemed difficult for students to identify the correct pharmacological treatments for common terminal symptoms, such as the "death rattle" (from decreased clearance of saliva) and anxiety. This is not entirely unexpected since preclinical students typically have had minimal exposure to pharmacology during the first two years of medical school when the curriculum is focused on physiology and pathophysiology rather than clinical

management. In comparison, the vast majority of students seemed more familiar with non-pharmacological management options, such as offering but not forcing food in the case of terminal anorexia.

These findings support the notion that EOL education should be a continuum that spans different stages of training, such as introducing the option of hospice care (including eligibility for enrollment and provision of services) in the pre-clinical setting while postponing the pharmacological treatment for terminal symptoms to the clinical years.

Our Findings in Relation to Current Research

Our study's findings on students' attitudes were consistent with findings in a previous study conducted at the Northeastern Ohio Universities College of Medicine (NEOUCOM) (Wear 2002, 271-277). In that study, whereby fourth-year medical students were asked to write an essay to describe their experiences with dying patients and their families, participants indicated that they not feel well prepared to provide care for dying patients and desired more support from residents and attending physicians. Moreover, the students at NEOUCOM believed that care of the dying can only be learned through direct clinical experience. While we certainly acknowledge the educational importance of face-to-face interactions with dying patients, we also see the utility of complementing virtual and experiential learning to provide an effective pre-clinical EOL and palliative care curriculum.

Online education provides a complementary mode of medical teaching that is flexible, convenient, and interactive (Curran and Fleet 2005, 561-567). Learners can choose the

pace of the program and the place of learning provided that there is access to the internet. Interactive features in the forms of multimedia, such as sound and video clips, and embedded quiz questions can increase learner engagement. In the grander scheme of learning and education: “E-learning offers a learner centered approach consistent with the adult learning theory where a direct and active learner involvement is conducive to subsequent behavior change”(Pelayo et al. 2011, 37-2296-12-37). When compared to e-learning, experiential learning is more time consuming but seems to have a greater effect on students’ attitudes. At Case Western Reserve University School of Medicine, first-year medical students who spent an afternoon at a hospice facility or an inpatient palliative care service had a modest, though statistically significant, increase in post-test compared to pre-test scores (82.5 and 80.2, respectively, $p < .05$) on a survey assessing attitudes towards dying patients (Wechter et al. 2015, 52-60).

Our results contrasted that of University of Alberta’s virtual patient study where Tan et. al found that students’ perceived personal comfort level with EOL management changed after completing a virtual patient case (Tan, Ross, and Duerksen 2013, 22711). In this study, they utilized a comprehensive palliative care case of a virtual patient who had non-small cell lung cancer. The students followed a longitudinal course of disease progression, from metastatic progression of the disease to hospice admission to death. Comparing pre- and post-test response, the authors reported that the students’ self-perceived comfort levels with EOL management (such as pain management, symptom control, and discussing limited prognosis status) increased significantly after completing the virtual patient case. This change in attitude resulting from e-learning contrasts our findings which did not show changes in attitudes. Perhaps the difference lies in the fact

that our e-learning projects somewhat differed, and a longitudinal case might be more impactful than separate case scenarios that illustrated different palliative/end-of-life care concepts.

Limitations

This study was conducted with medical students at a single medical school which may limit the generalizability of the results. The survey/quiz that we utilized showed inadequate internal consistency in most domains, though this was not unexpected since the attitude statements addressed different aspects of end-of-life care (of responsibility verses communication, or the importance of the inclusion EOL lessons in the curriculum verses its comparative importance to other topics) rather than a single domain. Moreover, our test contained a small number of items, which could contribute to a low Cronbach alpha value (Tavakol and Dennick 2011, 53). This could be overcome by using a more comprehensive knowledge quiz and attitudes survey, and using factor analysis to ensure sufficiency of testing in the knowledge/attitudes domains of interest. Moreover, alternative phrasing of questions and avoidance of inverse question prompts (e.g., choose the item *not* associated with X) could potentially improve consistency by limiting response errors if students misread the question.

CONCLUSIONS

Our newly developed “Life, Death, and Medicine: the Dying Process, Terminal Care, and Hospice Care” online module is a promising tool to increase second-year medical

students' knowledge. Complementing this e-learning tool with experiential clinical exposure can form an effective blended terminal and hospice care educational experience for pre-clinical medical students.

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