



Integrating High-Value Care Concepts into Preclinical Medical Education: A Practical Approach

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ABSTRACT

OBJECTIVES: Although some US medical schools have incorporated high-value care into their preclinical curriculum, there is no standardized approach and major curricular overhaul can be prohibitively onerous. The objectives of this study were to develop a feasible and effective high-value care curriculum, integrate it into an existing pre-clinical course, and assess student and faculty perceptions of the educational value of the curriculum.

METHODS: Between 2019 and 2021, University of Vermont preclinical medical students participating in the Students & Trainees Advocating for Resource Stewardship (STARS) program collaborated with the faculty director of the preclinical pathophysiology course to identify Choosing Wisely® recommendations relevant to course topics. For each recommendation, STARS students created a case-based, multiple-choice question, answer key and rationale to accompany standard course materials. At each year's course completion, participating students and faculty were invited to complete a survey to assess their perceptions of the curriculum.

RESULTS: Seventeen case-based questions were integrated into existing pathophysiology course sessions each year. Over the 3-year period, 420 students and 35 teaching faculty participated in the course, and 171 (40.7%) students and 24 (68.6%) faculty completed the post-course survey. Among student respondents, 80% agreed the curriculum increased their awareness of high-value care, 79% agreed they would be more likely to apply high-value care concepts during their medical career, and 92% agreed it was valuable to discuss Choosing Wisely® recommendations during the second year of medical school.

CONCLUSION: A student-led initiative to incorporate high-value care content within an existing pre-clinical course was well-received by medical students, who reported increased awareness of and intention to apply high-value care principles. This model may offer a feasible and effective approach to high-value care education in the absence of an extensive formal curriculum.

KEYWORDS: schools, medical, students, medical, curriculum, high value care

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Introduction

It is estimated that excess medical care spending constitutes 21% to 47% of US healthcare spending, representing \$803 billion to \$1.8 trillion annually.^{1,2} Overuse comprises the largest component of wasteful medical spending.^{1,2} In an effort to combat high medical costs, reduce overuse, and lessen the resulting harm to patients, the American Board of Internal Medicine started the Choosing Wisely® Campaign in 2012, seeking “to advance a national dialogue on avoiding unnecessary medical tests, treatments and procedures”.³ Further, the American Association of Medical Colleges recommends that medical students display proficiency in cost-effective care prior to matriculation into residency.⁴ As a result, some medical schools have begun to include principles of high-value care (HVC) in pre-clinical curricula.

However, the implementation of such curricula has posed a challenge, as there is currently no standardized or optimal approach to providing instruction in HVC. Some institutions

have begun to include HVC content separately from foundational coursework,^{5–7} but introduction of new courses into crowded curricula can be time-consuming and challenging. We sought to develop a feasible, effective, and sustainable approach to introduce pre-clinical medical students to HVC principles at our institution. By integrating relevant Choosing Wisely® recommendations and related educational materials into a pre-existing course, we aimed to increase student awareness of HVC in a manner which did not require major course revision, increase faculty teaching burden, or involve additional class hours. We hypothesized that such an approach to HVC curricula would be well-received by students and faculty alike.

Methods

Curriculum development

Between 2019–2021, nine medical students from the Robert Larner, MD College of Medicine at the University of Vermont



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(UVM) participated in the national Students & Trainees Advocating for Resource Stewardship (STARS) program, during which they were introduced to the ABIM Choosing Wisely® Campaign and instructed in basic principles of HVC.⁸ The process for developing the curriculum approximated the steps recommended by Shneiderhan et al.⁹ During the first year of STARS program participation, UVM students performed a general needs assessment and identified limited awareness of HVC principles among their pre-clinical student peers as the focus for a curricular intervention. The pre-clinical curriculum at UVM contained no dedicated educational strategy to teach HVC principles. After exploring a variety of possible curricular approaches and collaborating with a faculty mentor, they determined that major curricular revision, such as introducing a new course, would be challenging and ultimately infeasible. They believed their peers were eager to explore clinical applications of concepts taught in pre-clinical courses and felt that HVC principles could be embedded into an existing pre-clinical course using brief, case-based scenarios and Choosing Wisely® recommendations which aligned with course content. They identified the Cardiovascular, Respiratory, and Renal (CRR) pathophysiology course at UVM as having content related to many HVC principles and Choosing Wisely® recommendations. The UVM STARS students approached the director of the CRR course, who was supportive of integrating case-based HVC scenarios into existing course content. During the initial and each subsequent year, the UVM STARS students collaborated with the faculty course director for the CRR pathophysiology course at UVM to integrate HVC topics into the existing curriculum.

Four student learning objectives were established: (1) articulate the concept of high-value care; (2) identify examples of high-value and low-value practices for common cardiac, pulmonary and renal diseases; (3) describe the Choosing Wisely® initiative; and (4) apply high-value care concepts during future clinical training and medical career. UVM STARS students identified Choosing Wisely® recommendations relevant to topics that would be presented by faculty during specific course sessions (Table 1). For example, an introductory session on electrocardiogram (ECG) interpretation was identified as an opportunity to discuss clinical scenarios in which obtaining an ECG may be low-value. During each year, the STARS students selected 17 Choosing Wisely® recommendations to incorporate into separate CRR course sessions at least 3 months prior to the beginning of the course. The recommendations were selected based on their fit with the topic areas and course materials for specific sessions. For each recommendation, STARS students created a teaching worksheet which included a case-based, clinical multiple-choice question, the correct answer choice, brief rationale, information about the source of the recommendation and a link to supplemental information (Appendix A). With the permission of the course director, STARS students contacted teaching faculty directly to request the integration of the selected clinical recommendations into their class sessions. The teaching worksheets were provided via email

to teaching faculty prior to the start of the CRR course, and they were posted online for students to access alongside the traditional teaching materials for the related class sessions. While the STARS students suggested incorporating the clinical recommendation into the in-class presentation and discussion, the faculty member leading each session determined how to share the materials (ie, in-class discussion and online supplemental material vs online supplemental material only).

Curriculum assessment

We conducted a survey-based study of all students and faculty who participated in the HVC curriculum during the first 3 cohorts, corresponding to academic years 2019, 2020, and 2021. At the completion of the CRR course each year, participating students and faculty were invited to complete a survey to assess their perceptions of the educational value of the HVC component of the curriculum. The survey was developed by two of the authors, and had been previously piloted by 8 medical students and 2 faculty members as part of a separate curriculum, and revised for face and content validity. The survey was administered electronically and data were collected and managed using REDCap (Research Electronic Data Capture) electronic data capture tools hosted at the University of Vermont.¹⁰ Survey items contained Likert-style responses with a 1–5 scale, from “strongly disagree” to “strongly agree” (Appendices B and C). There was no explicit incentive to complete the survey. We elected to include three cohorts of students and faculty members in the curricular assessment, representing the first 3 years of curricular delivery, as we felt it would provide insights into the stability of the responses over time.

Statistical analyses

Descriptive statistics were used to summarize the survey responses. Mean responses for each survey item were compared between the initial year (2019) and the final year (2021) using independent-sample *t* tests, consistent with evidence that parametric tests are robust for analysis of Likert-scale responses.¹¹ Analyses were performed with Excel 2016 (Microsoft Corporation, Redmond, WA).

Ethical review

The UVM Research Protections Office determined the project was exempt from IRB review under federal exemption category 1, as research conducted in established or commonly accepted educational settings, involving normal educational practices (CHRMS STUDY00001736). The email invitation to participate in the survey and the preface to the survey instrument explained that survey participation was voluntary and anonymous, and would not affect job standing, class standing, grades, or evaluations. The UVM Research Protections Office approved a waiver of documentation of consent.

Table 1. Choosing Wisely® recommendations selected for curriculum sessions in pathophysiology course.

Course Session	Selected Choosing Wisely® Recommendation
Assessment of renal function	Don't request just a serum creatinine to test adult patients with diabetes and/or hypertension for CKD; use the Kidney Profile [serum creatinine with eGFR and urinary albumin-creatinine ratio]
ECG interpretation	Don't order annual electrocardiograms or any other cardiac screening for low-risk patients without symptoms
Diabetic kidney disease	Avoid NSAIDs in individuals with hypertension or heart failure or CKD of all causes, including diabetes
Heart failure, NSAID pharmacology	Avoid NSAIDs in individuals with hypertension or heart failure or CKD of all causes, including diabetes
Intravenous fluids	Avoid instituting intravenous fluids before doing a trial of oral rehydration therapy in uncomplicated emergency department cases of mild to moderate dehydration in children
Obstructive uropathy	Avoid ordering CT of the abdomen and pelvis in young otherwise healthy emergency department patients (age <50) with known histories of kidney stones, or ureterolithiasis, presenting with symptoms consistent with uncomplicated renal colic
Lung malignancy	Don't perform CT screening for lung cancer among patients at low risk for lung cancer
Obstructive lung disease	Don't diagnose or manage asthma without spirometry
Valvular disease pathology	Avoid performing echocardiography as routine follow-up for mild, asymptomatic native valve disease in adult patients with no change in signs or symptoms
Pediatric kidney disease	Don't order routine screening urine analyses in healthy, asymptomatic pediatric patients as part of routine well child care
Pulmonary embolism	Don't perform chest CT angiography to evaluate for possible pulmonary embolus in patients with a low clinical probability and negative results of a highly sensitive D-dimer assay
Pulmonary hypertension	Don't routinely offer pharmacologic treatment with advanced vasoactive agents approved only for the management of pulmonary arterial hypertension to patients with pulmonary hypertension resulting from left heart disease or hypoxemic lung diseases (Groups II or III pulmonary hypertension)
Pulmonary infections in children	Don't treat uncomplicated community-acquired pneumonia in otherwise healthy, immunized, hospitalized patients with antibiotic therapy broader than ampicillin
Pulmonary infections	Avoid prescribing antibiotics for upper respiratory infections
Respiratory disorders of infants & children	Don't use continuous pulse oximetry routinely in children with acute respiratory illness unless they are on supplemental oxygen
Respiratory disorders of infants & children	Don't order chest radiographs in children with uncomplicated asthma or bronchiolitis
Sudden cardiac death	Don't obtain screening exercise electrocardiogram testing in individuals who are asymptomatic and at low risk for coronary heart disease

Abbreviations: CKD, chronic kidney disease; CT, computed tomography; ECG, electrocardiogram; eGFR, estimated glomerular filtration rate; NSAIDs, nonsteroidal anti-inflammatory drugs

Results

The HVC curricular content was introduced in 2019 and continued through 2021, for three course iterations involving three unique classes of medical school students. Throughout the duration of the intervention, 420 pre-clinical medical students participated in the CRR course and 171 completed the survey (response rate 40.7%). A total of 35 faculty members were involved in the initiative from 2019 through 2021, with 24 faculty respondents to the survey (68.6% response rate).

Table 2 summarizes the medical student responses across the three years of assessment. Among all student respondents, 81% agreed that the intervention added a helpful clinical context to their foundational coursework and 92% agreed that the material was valuable to them as pre-clinical medical students, representing level 1 (reaction) results in the New

World Kirkpatrick Model of education program evaluation.¹² Additionally, 80% of students agreed the intervention increased their awareness of HVC and 79% reported that the curriculum would make them more likely to use HVC concepts in their future clinical practice, representing Kirkpatrick Model level 2 (knowledge and commitment).¹² Only 73.7% of students agreed or strongly agreed with the statement, “Because of this curriculum, I will be more likely to apply Choosing Wisely recommendations during my clinical training,” while 20.5% selected the “neutral” option, and 5.8% of the total respondents disagreed or strongly disagreed with statement.

Table 3 summarizes the faculty responses across the three years of assessment. Among all faculty responses, 75% indicated they were familiar with Choosing Wisely® recommendations prior to the intervention, 34% reported consulting Choosing

Table 2. Results of medical student survey: percentage of respondents selecting “agree” or “strongly agree”

Survey Item	2019	2020	2021	Total
Presentation of Choosing Wisely recommendations in CRR increased my awareness of high value care.	81.6	75.9	82.8	80.1
Exposure to Choosing Wisely recommendations in CRR was useful to me.	79.6	79.3	84.4	81.1
Discussion of Choosing Wisely recommendations provided helpful clinical context to CRR course content.	79.6	77.6	90.6	82.6
It is valuable to discuss Choosing Wisely recommendations during the second year of medical school.	98	87.9	90.6	92.2
Because of this curriculum, I will be more likely to apply Choosing Wisely recommendations during my clinical training.	73.5	72.4	75.1	73.7
Because of this curriculum, I will be more likely to use high value care concepts during my medical career.	77.6	75.9	84.4	79.3
I would recommend continuing to include Choosing Wisely recommendations in CRR for future students.	87.8	86.2	93.8	89.3

Table 3. Results of faculty survey: percentage of respondents selecting “agree” or “strongly agree”

Survey Item	2019	2020	2021	Total
Presentation of Choosing Wisely recommendations in CRR increased students' awareness of high value care.	44.4	71.5	87.5	67.8
Discussion of Choosing Wisely recommendations provided students with helpful clinical context to CRR course content.	55.5	71.5	75	67.3
It is valuable for students to discuss Choosing Wisely Recommendations during the second year of medical school.	55.5	85.8	100	80.4
I would recommend continuing to include Choosing Wisely recommendations in CRR for future students.	55.5	58.5	75	63
I was familiar with Choosing Wisely recommendations prior to their incorporation into the CRR curriculum.	77.8	85.7	62.5	75.3
Incorporation of Choosing Wisely recommendations in CRR increased my familiarity with Choosing Wisely.	22.2	85.7	50	52.6
I regularly consult Choosing Wisely recommendations in my clinical practice.	33.3	42.9	25	33.7
I am more likely to apply Choosing Wisely recommendations in my clinical practice, following their integration into the CRR curriculum.	33.3	42.9	37.5	37.9
I am more likely to apply Choosing Wisely recommendations in my future teaching, following their integration into the CRR curriculum.	55.5	57.2	75	62.6

Wisely® regularly in clinical practice, and 63% indicated a higher likelihood of applying Choosing Wisely® recommendations in their future teaching as a result of the intervention. In total, 68% of faculty respondents agreed the intervention increased students' awareness of HVC and 67% agreed it provided students with helpful clinical context to the CRR course content. When asked if they believed that the material was valuable to pre-clinical medical students, 56% of faculty respondents agreed at the conclusion of the first year of the intervention, while 100% agreed at the conclusion of the third year of the intervention, though the observed difference in the mean response scores (3.8, SD 1.30 vs 4.6, SD 0.52) lacked statistical significance ($p = 0.11$)

Discussion

A student-lead HVC curriculum integrated into an existing pre-clinical course proved to be feasible and was perceived favorably by students. With increasing demand to incorporate HVC education into the undergraduate medical years, we feel that this approach may offer a practical, effective, and sustainable alternative to major curricular overhaul.

There are several strengths that our intervention offers. First, it is readily implemented because it does not require large scale curricular change. It was intentionally designed to make it easy for faculty to incorporate the material into their teaching sessions and supplementary class materials. The intervention also appeared effective in achieving some objectives. Based on student self-report, the curriculum increased student familiarity with HVC concepts, as well as their intention to apply HVC principles in future clinical training and medical practice.

Over the first 3-years of the HVC curriculum, medical students consistently reported positive perceptions of the HVC content integration into the preclinical course materials. In contrast, some faculty initially reported reservations about the utility of incorporating HVC content into the preclinical curriculum. Although there were no statistically significant changes in faculty perception over time, we anecdotally observed increasing faculty receptiveness to incorporating HVC content into course sessions, paralleling the non-significant trend in faculty responses regarding the value of the HVC content during the second year of medical school.

While student perceptions were favorable for all survey items, the lowest level of student agreement was observed for

the survey item, “Because of this curriculum, I will be more likely to apply Choosing Wisely recommendations during my clinical training.” We speculate that the increased use of the neutral response option for this item reflects students’ uncertainty about their future practice of clinical medicine – equivalent to an “I don’t know / unsure” response – rather than overt disagreement. Alternatively, the presentation of these concepts in the context of a preclinical physiology course may make it difficult for students to appreciate how they might apply the concepts in their future clinical training. While many of the case-based scenarios focused on general medicine and pediatrics conditions, students anticipating a career in other specialties may have felt that the recommendations would not be relevant in their clinical training and practice.

Several limitations to this approach must be acknowledged. The success of this intervention requires engaged students who have foundational training or experience in HVC, a motivated course director, and receptive teaching faculty. Additionally, assessment was based on self-report and we did not evaluate higher Kirkpatrick Model levels of learning, such as the actual application of HVC principles in clinical practice. The survey did not specifically gauge students’ content knowledge, limiting the ability to determine the effectiveness of the curriculum in achieving some of the student learning objectives such as “articulate the concept of high-value care.” A relatively low student response rate introduces the possibility of sampling bias. The 171 completed student surveys fell short of the 201 required to provide a 95% confidence level that the population responses would be within $\pm 5\%$ of the surveyed response values. There is also the potential for response bias, especially among students who may be inclined toward favorable responses because their peers were helping to spearhead the curricular initiative. We observed inconsistent fidelity of the intervention between faculty members, with some faculty members discussing the cases in depth during class sessions and others choosing to include the content only as supplemental on-line material. We did not track whether students accessed the supplemental on-line material or compare student perceptions of content discussed in class versus offered only on-line. The lack of a formal conceptual framework may reduce the generalizability of the curriculum. Finally, our intervention was designed and implemented at a single center, and perspectives of both students and faculty at other institutions may differ from those at UVM.

Although the initiative involved only one medical school, we feel that the broad array of Choosing Wisely® recommendations available and the similarity of course content in undergraduate medical education allow this approach to be generalizable to pre-clinical courses at other medical schools, with modifications to suit individual institutions’ preclinical educational themes and teaching methodologies. We have also found the intervention to be sustainable. Once curricular materials have been designed and introduced, maintenance

requires only minor revisions from year to year as the core pre-clinical curriculum is updated. While STARS students were instrumental in implementing the curriculum at UVM, medical students interested in high value care could develop and maintain similar curricula as part of a mentored student interest group or an education elective experience. Future steps for this curriculum at UVM include comparison of the perceived educational value of content discussed in class versus offered only on-line, and standardization of the approach to content delivery based on the results. Assessing the impact of this curriculum on higher-level educational outcomes, such as students incorporating HVC recommendations into their notes or presentations during future clinical courses, may inform medical schools as they seek to incorporate HVC concepts into their curricula.

Conclusion

An innovative, student-led curriculum that integrates HVC content directly into existing pre-clinical course sessions may offer a practical approach to increase medical student familiarity with and intent to apply HVC principles, and address the demand for HVC education in the undergraduate medical years without extensive curricular overhaul.

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Supplemental material

Supplemental material for this article is available online.

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