Title: Medical Students’ Awareness About Value-Based Health Care in Brazil: A Cross Sectional Study

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Authors Contribution Statement:

<table>
<thead>
<tr>
<th>Contributor Role</th>
<th>Role Definition</th>
<th>Authors</th>
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<tbody>
<tr>
<td>Conceptualization</td>
<td>Ideas; formulation or evolution of overarching research goals and aims.</td>
<td>X  x  x  x  x</td>
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<tr>
<td>Data Curation</td>
<td>Management activities to annotate (produce metadata), scrub data and maintain research data (including software code, where it is necessary for interpreting the data itself) for initial use and later reuse.</td>
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<tr>
<td>Formal Analysis</td>
<td>Application of statistical, mathematical, computational, or other formal techniques to analyze or synthesize study data.</td>
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<tr>
<td>Funding Acquisition</td>
<td>Acquisition of the financial support for the project leading to this publication.</td>
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<tr>
<td>Investigation</td>
<td>Conducting a research and investigation process, specifically performing the experiments, or data/evidence collection.</td>
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<tr>
<td>Methodology</td>
<td>Development or design of methodology; creation of models.</td>
<td>x  x  x  x  x  x</td>
</tr>
<tr>
<td>Project Administration</td>
<td>Management and coordination responsibility for the research activity planning and execution.</td>
<td>x  x</td>
</tr>
<tr>
<td>Resources</td>
<td>Provision of study materials, reagents, materials, patients, laboratory samples, animals, instrumentation, computing resources, or other analysis tools.</td>
<td>x  x</td>
</tr>
<tr>
<td>Software</td>
<td>Programming, software development; designing computer programs; implementation of the computer code and supporting algorithms; testing of existing code components.</td>
<td></td>
</tr>
<tr>
<td>Supervision</td>
<td>Oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team.</td>
<td>x  x  x</td>
</tr>
<tr>
<td>Validation</td>
<td>Verification, whether as a part of the activity or separate, of the overall replication/reproducibility of results/experiments and other research outputs.</td>
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</tr>
<tr>
<td>Visualization</td>
<td>Preparation, creation and/or presentation of the published work, specifically visualization/data presentation.</td>
<td>x  x  x  x  x  x</td>
</tr>
<tr>
<td>Writing – Original Draft Preparation</td>
<td>Creation and/or presentation of the published work, specifically writing the initial draft (including substantive translation).</td>
<td>x  x  x  x  x</td>
</tr>
<tr>
<td>Writing – Review &amp; Editing</td>
<td>Preparation, creation and/or presentation of the published work by those from the original research group, specifically critical review, commentary or revision – including pre- or post-publication stages.</td>
<td>x  x  x  x  x  x  x</td>
</tr>
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</table>

*Equal contribution

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Discussion Points:

1. We conducted a pioneer study to quantify VBHC awareness in a medical student population nationwide (Brazil).
2. The survey included over 3,000 responses, representing all states of Brazil across 148 institutions.
3. We found a low level of awareness on the topic and relevant intrinsic and extrinsic factors that can influence the exposure to this important topic in medical education, such as interest in pursuing training and a career MBA in healthcare management.
4. Our results suggest that medical schools have the potential to reinforce both intrinsic and extrinsic factors related to VBHC awareness through education and extracurricular activities) to prepare future doctors to practice in a Value-driven context.
ABSTRACT.

Background: The rising healthcare costs demand a transition from the current fee-for-service to a Value-Based Health Care (VBHC) Model. This requires all future doctors to understand VBHC. We aimed to evaluate VBHC awareness-level among Brazilian medical students and to identify the associated intrinsic/extrinsic factors.

Methods: This was a survey based, cross-sectional study, conducted through an online survey applied to students from Brazilian medical schools. A descriptive analysis based on participants' level of awareness about VBHC was performed. The categorical variables included were absolute and relative frequencies using chi square tests. A multivariate binary logistic regression analysis was performed by calculating the odds ratio (OR) and 95% confidence intervals (95%CI), to compare each response according to VBHC awareness.

Results: We collected 3030 responses, from 148 Medical Schools across all Brazilian states. Medical students were compared in 2 groups; 1 was familiar with VBHC (14%; 426); 2 was not (86%; 2575). The univariate analysis showed that group 1 was more willing to share clinical outcomes/costs data related to their practice (57.04%) compared to 2 (48.12%). The multivariate analysis showed that internship experience was the most relevant factor associated with VBHC exposure (OR 4.32 [CI 95% 1.82 - 10.24]).

Conclusion: We found that few medical students understand VBHC concepts, and that exposure was due to self-education efforts. Our results suggest that medical schools have the potential to reinforce both intrinsic and extrinsic factors related to VBHC knowledge to prepare future doctors to practice in a value-driven context.

Key Words: Delivery of Health Care, Health Care Costs, Medical Students, Brazil
INTRODUCTION.

Every year, healthcare costs increase significantly, representing more than 10% of the world's Gross Domestic Product (GDP).\(^1\) In the United States 17.07% of the GDP is spent on health, while in Brazil the rate is 11.77%.\(^1\) However, spending more does not necessarily mean better quality of health. This dissonance between costs and quality is mainly the result of the current payment model, fee-for-service, which stimulates volume of services over outcomes achieved.\(^2\) In 2006, Porter and Teisberg coined the term value-based health care to refer to a strategy aimed at restructuring health care systems and maximizing value for patients. In this proposal, value is the relationship between the outcomes that matter to patients over the costs to achieve these outcomes.\(^3\)

In Latin America, there are only a few initiatives to implement Value-Based Health Care Models.\(^5\)-\(^7\) These initiatives are necessary to foster the transition from the current flawed model towards one focused on health promotion and outcomes achieved and demand the timely inclusion of this topic in medical training programs.\(^7\),\(^8\) In order to advance with VBHC implementation, it is key to educate all healthcare stakeholders. An analysis of 255 citations of 12 VBHC trend-starting articles pointed that although the VBHC discussion is spreading through medical journals, a significant proportion of the publications miss the exact understanding of the aspect they are discussing or referring to and the authors conclude that a diffusion of shallow knowledge in underway.\(^9\) In Brazil, a survey conducted in a private nonprofit organization, Makdisse M et al demonstrated that the level of awareness on VBHC is still low among physicians with only 27% percent of them referring to being familiar with the VBHC concepts.\(^10\) Of note, among physicians in executive roles, the rate was 80%.\(^10\)

An effective way to increase the awareness among healthcare professionals would be to include VBHC in the curriculum of medical and other health undergraduate programs. A first step could be to understand the current context and degree of familiarity of medical students on VBHC core concepts and to our knowledge, there is no published study that assesses the degree of awareness of future doctors on value-based care. Therefore, the aim of this study was to capture the degree of awareness among Brazilian medical students about VBHC and to correlate the intrinsic and extrinsic factors with VBHC exposure. We hypothesize that this awareness is still low, especially due to the recent discussion of the topic and its absence in the formal medical school curriculum. In this way, beyond spreading the Value concepts, we may establish a baseline level of VBHC awareness and compare with post intervention assessments.
METHODS

This was a cross-sectional study, based on an electronic survey applied to medical students from 148 Brazilian medical schools, located in the five Brazilian regions, including both public and private schools.

The eligibility criteria consisted of medical students enrolled in Brazilian medical schools between January 2019 to December 2020 and who signed an electronic consent form. The selection method was online based, with the survey sent through social media, email and WhatsApp with no paid advertisements. The survey was open from November 2019 to June 2020. In order to prevent selection bias, we advertised the survey beyond the direct connections of the authors. We contacted student organizations from universities from all states of Brazil to help us in advertisement. Due to the exploratory nature of this study, the sample size was not calculated. This study was approved by the ethical committee from Universidade Passo Fundo (Brazil) with the reference number 3.681.791 and received no funding.

The survey questions (Appendix 1) were developed based on similar study adapted to the Brazilian context. The primary endpoint was to determine the self-reported level of awareness on Value-Based Health Care among medical students. Secondary endpoint were to assess intrinsic and extrinsic factors related to this level of awareness. Intrinsic factors were: age, gender, previous college degree obtained, medical area of interest, interest in pursuing academic programs other than medical school, participation in extracurricular activities, interests beyond the medical field. Extrinsic factors included medical school year, university name (its location, whether management and health systems classes were included in the curriculum, teaching methodology, existence of health management/health consulting club).

To compare students regarding their level of awareness on VBHC, answers to the question 6 (How do you rate your degree of familiarity with the topic "Value-Based Healthcare"?) on the online survey were transformed into binary variables, where “yes” (high level of awareness on VBHC) was considered if options “a, b or c” had been selected, and no (low level of awareness on VBHC) for all of the others (See questionnaire in the Appendix 1), in order to make groups more homogeneous and to reduce the degrees of freedom of the variables.

A descriptive analysis based on participants’ level of awareness about VBHC was performed. The continuous variables included were mean, standard deviation, median and interquartile range. The normality assumptions were tested a priori. When normality assumptions were met, t tests were performed, if not, non-parametric tests (Mann-Whitney U or Kruskal-Wallis) were used.

The categorical variables included were absolute and relative frequencies using chi square tests. A multivariate binary logistic regression analysis was performed by calculating the odds ratio (OR) and 95% confidence intervals (95%CI), to compare each response according to VBHC awareness.

The software used for statistical analysis was R version 3.6.0. Statistical significance considered was 5%.
RESULTS.

Descriptive Analysis

A total of 3,030 medical students completed the survey, corresponding to 148 institutions, across 24 states of Brazil and the Federal District. Thirty-three responses were not considered in the analysis because either the participant did not sign the consent form or provided incomplete information. Among participants, 63.6% were female and the mean age was 22.6 years old, with a standard deviation of 3.1 years, male respondents with a mean age of 22.7 years and a standard deviation of 3.6 years. Regarding the medical students' profile, 34% were in 1st and 2nd year, 38% in 3rd and 4th year and 28% in 5th and 6th year, these last two are equivalent to the rotation years in the United States.

In Table 1, we divided participants in two groups: group 1 consisted of students who declared to be familiar with VBHC (14.19%; 426) and group 2 with those who were not (85.81%; 2575). Overall, 53.91% correctly identified Porter’s concept of Value, with no statistical significance between the two groups. However, group 1 was more likely to know Porter’s value equation (9.39% vs 0.43%; p<0.01) and to indicate correctly both components of the formula in order, outcomes (14.08% vs 4.97%; p<0.01) and costs (17.37% vs 5.75%; p<0.01). Altogether, only 4.19% of participants got Porter’s formula correct. Regarding their future as healthcare professionals, group 1 noted that knowing the costs of care would impact their practice (82.63% vs 78.64%; p=0.02) and considered that health outcomes should play a key role in reimbursement for care delivery (49.53% vs 41.51%; p<0.01). Likewise, they were more open to be evaluated and compared to other doctors by patients (32.86% vs 25.36%; p <0.01).

With respect to intrinsic factors, group 1 was more familiar with payment models (global budget [55.87% vs 42.6%], fee-for-service [57.04% vs 49.28%], bundles [23.24% vs 12.58%] and pay-for-performance [19.01% vs 9.55%], all p<0.01). The same students were more likely to have completed another undergraduate course before medical school (7.04% vs 4.66%; p=0.02) and to participate in student organizations (34.74% vs 27.11%; p < 0.01), NGOs (13.85% vs 8.04; p<0.01) or Junior Enterprises (5.4% vs 1.24%; p<0.01). Moreover, they intended to follow careers in management (11.74% vs 6.06%; p<0.01) and pursue a Master in Business Administration (MBA) in the future (19.95% vs 8.47%; p<0.01). Finally, they showed more interests in fields others than medical practice, such as innovation (43.66% vs 35.69%; p<0.01), research (52.82% vs 46.87%; p=0.01), patient safety (36.62% vs 27.07%; p<0.01), health economics (31.46% vs 19.26%; p<0.01) and health policy (36.88% vs 26.06%; p<0.01).

In regards to teaching methodology, students familiar with VBHC were more often taught through active learning methodologies (Problem-Based Learning [11.5% vs 10.83%] and Team-Based Learning [10.33% vs 5.67%]; p<0.01). Similarly, those aware of VBHC were more often required to attend a mandatory healthcare management course (39.91% vs 28.82%; p<0.01) where payment models were debated (15.02% vs 8.04%; p<0.01) and were also more likely to attend optional management lectures (47.89% vs 23.82%; p<0.01) and participate in Junior Enterprises (10.56% vs 5.01%; p<0.01).
Multivariate Analysis
The multivariate analysis presented in Table 2 showed that the most frequent way of contact with VBHC concepts cited by respondents was through internships (OR 4.32, 95%CI 1.82 - 10.24). We hypothesize that students who seek out job opportunities during medical school are more inclined to actively learn by themselves and to get updated on market trends. Similarly, group 1 was more likely to know Porter’s Value Formula (OR 6.95, 95%CI 1.74 - 27.9) and to recognize the importance of discussing clinical outcomes during medical school (OR 20.83, 95%CI 1.59 - 272.11). We recognize that future studies are necessary to investigate whether extrinsic factors could increase VBHC awareness. In this study, medical school classes could not be considered the source of VBHC exposure (OR 1.44, 95%CI 0.83 - 2.5). Likewise, the discussion of payment systems in medical school curricula was not significantly correlated to VBHC knowledge (OR 1, 95%CI 0.29-3.42).
DISCUSSION.

In this study, only 14.19% (426) of the assessed population was found to be familiar with VBHC concepts, a rather small percentage of students, considering the implications of this sample representing part of the future healthcare workforce in Brazil. We have not found any previous studies that analyzed the familiarity of medical students with VBHC. When compared to doctors in a top tier non-profit hospital in Brazil, this number is also small (14.19% vs 27%). This result suggests that most doctors don't know VBHC concepts and, when they are familiar with them, the exposure happens mostly after they graduate from medical school. Although it is recognized that VBHC is essential to prepare doctors for 21st century medical practice, there are still several barriers that delay this aspect of education. Therefore, we stand the hypothesis that VBHC concepts are unknown by most of the future and present medical workforce in Brazil.

The medical students who declared to be familiar with VBHC share specific intrinsic and extrinsic traits. Some characteristics depend mostly on the medical school, such as the existence of a mandatory Health Management course, which increases the likelihood of a student being familiar with VBHC concepts (39.91% vs 28.82%). Less than half of the students that declared that they had a mandatory management discipline were familiar with VBHC, which points out that this concept is still not well worked out in medical schools. The existence of a Healthcare Systems discipline, present in more than 90% of the Brazilian medical schools reported, did not increase the likelihood of familiarity with VBHC.

In the United States, despite the effort to include VBHC in the undergraduate medical education through Health Systems Sciences, the VBHC curricula remains nonuniform, varying from multi-year activities during medical school to brief didactic sessions during clerkships. In a recent survey in the US, clerkship directors cited a lack of generalizable curricular materials and local faculty expertise as main barriers to implementing VBHC education. In order to address these challenges, Dell Medical School at University of Texas in Austin has incorporated VBHC into the undergraduate curriculum. Throughout the four years of training, students are introduced to the core concepts of VBHC and they experiment VBHC-in-practice during their clinical rotations in UT Health Austin’s affiliated clinics that have implemented Integrated Practice Units for different medical conditions. Through a partnership with the Value Institute for Health and Care, third-year medical students are also offered the opportunity to participate in a dual degree program including the Master of Science in Health Care Transformation, which equips health care professionals to lead change, catalyze transformation and create high-value services in their field. Students can also access the open-online interactive modules called ‘Discovering VBHC’, aimed at teaching the foundations of VBHC to different types of health professionals and also can be accessed and incorporated independently across diverse educational settings.

Other two examples of VBHC curriculum implementation are The Mayo Clinic Alix School of Medicine (MCASOM) and Harvard Medical School (HMS). MCASOM developed a program whose objective is “to ensure that graduating medical students enter residency prepared to train and eventually practice within person-centered, community- and population-oriented, science-driven, collaborative care teams delivering high-value care.” This objective is being pursued through a 4-week course distributed throughout 4 years of medical school. The course is organized around 6 domains, one of them is the High Value Domain, which focuses on three
main desired outcomes: applying scientific literature in patient care; improving the system; and balancing quality and cost in patient care.\textsuperscript{15} In HMS, students take two 4-week courses. The first one, applied during the first year of medical school, covers foundational topics in clinical epidemiology and population health, health policy, social medicine and medical ethics. The second (after a minimum of 12 months of clinical rotations) includes advanced topics in these disciplines and it is taken in collaboration with Harvard Business School (HBS), using the case method, with which they provide detailed information about a single organization to focus in-class discussions around key elements of VBHC.\textsuperscript{15}

Furthermore, a significant proportion of the students familiar with VBHC concepts share intrinsic traits, partially dependent from medical schools. Interest in following a career in management and a desire to pursue an MBA almost doubles the likelihood of a student being familiar with VBHC 11.74\% vs 6.06\% and 19.95\% vs 8.47\% respectively. Moreover, engagement in extracurricular activities exposes students to VBHC concepts and increases students’ awareness of VBHC concepts (16.16\% vs 11.74\%) which demonstrates that this knowledge is still mostly reserved to the students open to seek knowledge outside the medical school education. Therefore, medical schools interested in promoting VBHC knowledge among their students are more likely to achieve this objective not only through required VBHC curricula, but also promoting extracurricular activities. According to the multivariate analysis presented in Table \textit{2}, we found that the most frequent way of respondents contact with VBHC concepts was through internships. Although this result may seem to minimize the effect of intrinsic factors on VBHC knowledge, we believe that successful strategies need to mix both intrinsic and extrinsic factors.

We believe that familiarity with VBHC concepts is correlated to future professional decisions. Based on the survey, there is a correlation between being familiar with VBHC and accepting to have outcomes and costs monitored and compared to peers’ data. Also, students familiar with value-based health care are more prone to accept being paid according to outcomes and to be ranked by patients. Therefore, exposing medical students to the concepts of VBHC early in their careers might facilitate future attempts on the implementation of the value agenda.

The limitations of this study include the inherent factors of a cross sectional study with voluntary participants, the uneven distribution of responses in the country and the absence of a validated questionnaire. Although we had a representative sample including participants from all states of Brazil, most (86\%) of the responses were from southern and southeastern universities, which correspond to the regions where the majority of Brazilian medical schools are located (58\%). Furthermore, since all medical schools adhere to a national curriculum under the Brazilian Ministry of Education, we believe that the responses acquired from this study have a relatively high external validity. Another limitation to this study is the absence of a validated questionnaire, including objective measures to evaluate VBHC familiarity, with the exclusive use of the subjective perception of self-awareness about the subject, which can vary widely among survey responders. Furthermore, an active search to analyze curricula of the Brazilian medical schools was not conducted but analyzed indirectly through student’s reports.

One of the purposes of this study is to spread the word on the VBHC strategy among future healthcare professionals in Brazil, which justifies the selection specifically of the Brazilian population of medical students.
Future perspectives include the implementation of interventions to promote the learning of VBHC in undergraduate medical education and the international analysis of VBHC familiarity among medical students from several countries.
REFERENCES.


Figure 1. Flowchart of Responses Added to the Study.

Accessed the survey \( n = 3031 \)

Eligible responses \( n = 3001 \)

Exclusion criteria* \( n = 30 \)

Highly awareness of VBHC \( n = 426 \)

Low/no awareness of VBHC \( n = 2575 \)

*Excluded responses were due to no consent form signature or absent response on the degree of VBHC awareness.
Table 1. Students Characteristics and Career Interests According to VBHC Awareness.

<table>
<thead>
<tr>
<th>Variable</th>
<th>High level of awareness on VBHC (n=426)</th>
<th>Low level of awareness on VBHC (n=2575)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>242 (56.81%)</td>
<td>1670 (64.85%)</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>Male</td>
<td>184 (43.19%)</td>
<td>905 (35.5%)</td>
<td></td>
</tr>
<tr>
<td>Progression in Medical School</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st year</td>
<td>49 (11.15%)</td>
<td>354 (13.75%)</td>
<td></td>
</tr>
<tr>
<td>2nd year</td>
<td>81 (19.01%)</td>
<td>538 (20.89%)</td>
<td></td>
</tr>
<tr>
<td>3rd year</td>
<td>107 (25.12%)</td>
<td>642 (24.93%)</td>
<td></td>
</tr>
<tr>
<td>4th year</td>
<td>67 (15.73%)</td>
<td>323 (12.54%)</td>
<td></td>
</tr>
<tr>
<td>5th year</td>
<td>65 (15.26%)</td>
<td>402 (15.61%)</td>
<td></td>
</tr>
<tr>
<td>6th year</td>
<td>57 (13.38%)</td>
<td>316 (12.27%)</td>
<td></td>
</tr>
<tr>
<td>Does your university have a mandatory healthcare management class?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>170 (39.91%)</td>
<td>742 (28.82%)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>100 (23.47%)</td>
<td>627 (24.35%)</td>
<td>p &gt; 0.01</td>
</tr>
<tr>
<td>No, but there is an optional option</td>
<td>23 (5.4%)</td>
<td>120 (5.47%)</td>
<td></td>
</tr>
<tr>
<td>I don’t know</td>
<td>133 (31.22%)</td>
<td>1086 (42.17%)</td>
<td></td>
</tr>
<tr>
<td>Do you have any previous college degree?</td>
<td></td>
<td></td>
<td>p = 0.02</td>
</tr>
<tr>
<td>Yes</td>
<td>30 (7.04%)</td>
<td>120 (4.66%)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>396 (92.96%)</td>
<td>2455 (95.34%)</td>
<td></td>
</tr>
<tr>
<td>What is your medical area of interest?</td>
<td></td>
<td></td>
<td>p = 0.09</td>
</tr>
<tr>
<td>Internal Medicine</td>
<td>233 (54.69%)</td>
<td>1514 (58.8%)</td>
<td></td>
</tr>
<tr>
<td>Surgery</td>
<td>192 (45.07%)</td>
<td>1138 (44.19%)</td>
<td>p = 0.71</td>
</tr>
<tr>
<td>Management</td>
<td>50 (11.74%)</td>
<td>156 (6.06%)</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>Research</td>
<td>73 (17.14%)</td>
<td>349 (13.55%)</td>
<td>p = 0.03</td>
</tr>
<tr>
<td>Do you have interest in pursuing academic programs other than medical school?</td>
<td></td>
<td></td>
<td>p = 0.1</td>
</tr>
<tr>
<td>Residency Program</td>
<td>416 (97.65%)</td>
<td>2539 (98.6%)</td>
<td></td>
</tr>
<tr>
<td>Masters /PhD</td>
<td>241 (56.57%)</td>
<td>1400 (54.37%)</td>
<td>p = 0.36</td>
</tr>
<tr>
<td>MBA</td>
<td>85 (19.95%)</td>
<td>218 (8.47%)</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>What extracurricular activities have you engaged in?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students/Sports Associations</td>
<td>148 (34.74%)</td>
<td>698 (27.11%)</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>Junior Enterprises</td>
<td>23 (5.4%)</td>
<td>32 (1.24%)</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>Startups</td>
<td>18 (4.23%)</td>
<td>22 (0.85%)</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>NGOs</td>
<td>59 (13.85%)</td>
<td>207 (8.04%)</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>Do you have any interest beyond healthcare?</td>
<td></td>
<td></td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>Research</td>
<td>225 (52.82%)</td>
<td>1207 (46.87%)</td>
<td></td>
</tr>
<tr>
<td>Innovation</td>
<td>186 (43.66%)</td>
<td>919 (35.69%)</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>Patient Safety</td>
<td>156 (36.62%)</td>
<td>697 (27.07%)</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>Healthcare Economics</td>
<td>292 (68.54%)</td>
<td>2079 (80.74%)</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>Artificial Inteligency</td>
<td>132 (30.99%)</td>
<td>500 (19.42%)</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>Healthcare Policies</td>
<td>155 (36.38%)</td>
<td>671 (26.06%)</td>
<td>p &lt; 0.01</td>
</tr>
</tbody>
</table>
Table 2. Results of a Multivariate Analysis Used to Determine Which Factors are Associated with High VBHC Awareness Compared to Low VBHC Awareness.

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR (95%CI)</th>
<th>Respondents (Yes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous exposure to VBHC</td>
<td>12.53 (7.53 - 20.85)</td>
<td>599</td>
</tr>
<tr>
<td>Exposure to VBHC through internships</td>
<td>4.32 (1.82 - 10.24)</td>
<td>73</td>
</tr>
<tr>
<td>Exposure to VBHC through conferences and lectures</td>
<td>1.71 (0.99 - 2.94)</td>
<td>194</td>
</tr>
<tr>
<td>Exposure to VBHC through extracurricular activities</td>
<td>1.62 (0.87 - 3.0)</td>
<td>126</td>
</tr>
<tr>
<td>Exposure to VBHC through articles</td>
<td>1.57 (0.67 - 3.71)</td>
<td>66</td>
</tr>
<tr>
<td>Exposure to VBHC through medical school classes</td>
<td>1.44 (0.83 - 2.5)</td>
<td>191</td>
</tr>
<tr>
<td>Do you know the &quot;Value&quot; formula presented by Porter and Teisberg (2006)?</td>
<td>6.95 (1.74 - 27.9)</td>
<td>51</td>
</tr>
<tr>
<td>Do you consider it important to discuss &quot;outcomes&quot; during medical school?</td>
<td>20.83 (1.59-272.11)</td>
<td>2949</td>
</tr>
<tr>
<td>Do you consider it important to discuss &quot;costs&quot; during medical school?</td>
<td>0.38 (0.1-1.5)</td>
<td>2907</td>
</tr>
<tr>
<td>Do you consider it important to discuss &quot;payment systems&quot; during medical school?</td>
<td>1 (0.29 - 3.42)</td>
<td>2882</td>
</tr>
<tr>
<td>Are you aware of any payment system?</td>
<td>0.5 (0.27-0.93)</td>
<td>1908</td>
</tr>
<tr>
<td>Do you think that knowing the costs of your medical practice influences how you practice medicine?</td>
<td>1.02 (0.62 - 1.67)</td>
<td>2377</td>
</tr>
<tr>
<td>Do you think that knowing the outcomes of your medical practice influences how you practice medicine?</td>
<td>1.22 (0.52 - 2.85)</td>
<td>2795</td>
</tr>
<tr>
<td>Would you be willing to have the outcomes and costs of your medical practice monitored and compared to other physicians' performance?</td>
<td>1.1 (0.47 - 2.6)</td>
<td>2901</td>
</tr>
<tr>
<td>Would you be willing to share data of the outcomes and costs of your medical practice in order to contribute to reduce costs and improve healthcare quality?</td>
<td>1.45 (0.94 - 2.23)</td>
<td>2737</td>
</tr>
</tbody>
</table>

*CI=Confidence intervals, OR=odds ratio

In bold, we presented the results with significant p values (p <0.05)
Appendix 1 - Research Instrument. Online questionnaire sent to medical students.

1. Email Address
2. Informed Consent Form attached
   I agree
   I do not agree (survey ends if this button is clicked)

3. I am a medical student with active enrollment in the current semester
   Yes
   No (survey ends if this button is clicked)

4. Have you ever had contact with the subject of Value-Based Healthcare?
   Yes
   No

5. If you answered "YES" in the previous question, how did you get in touch? (Open question)
   University Lectures
   Extracurricular activities
   Internships, professional experiences
   Scientific Articles
   Congresses and seminar lectures
   Electronics (Youtube, TED, Coursera, edX or other platforms)
   Courses
   Other:

6. How do you rate your degree of familiarity with the topic "Value-Based Healthcare"?
   I am enthusiastic about the topic and I try to keep myself updated on initiatives involving VBHC
   I am familiar with the topic and already read some articles or attended lectures on the topic.
   I am familiar with the topic but I have never read articles or attended lectures on the topic.
   I had little contact with the topic and I don't feel comfortable discussing it
   I never had contact with the topic

7. How do you define "Value" in Health?
   It is the patient's perception of the benefits obtained from the treatment in relation to the amount paid for it, regardless of the clinical result
   It is the amount of money paid for a treatment
   Achieve a high degree of patient satisfaction even if clinical results and costs are outside expected values
   Clinical results (outcomes that matter to the patient) obtained in relation to the costs to achieve these outcomes

8. In your opinion, how important should each of the following factors be in defining the remuneration for the medical service?

<table>
<thead>
<tr>
<th></th>
<th>1 - Irrelevant</th>
<th>2 - Not very important</th>
<th>3 - Important</th>
<th>4 - Very Important</th>
<th>5 - Fundamental</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity of services provided</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time spent in the service</td>
<td>Complexity of the service</td>
<td>Outcomes delivered at the end of the service</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------------------------</td>
<td>---------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. **When you graduate, you intend to:**
   1. Work as a self-employed physician
   2. Work as an employee in a fixed institution or practice.
   3. Act as an employee physician in a fixed institution or practice and maintain some degree of self-employment.
   4. I do not know.

10. **Do you think that knowing the outcomes of your clinical practice influences the way you carry out your clinical practice?**
    1. Yes, knowing the costs influences the way I do my clinical practice.
    2. No, knowing the costs doesn't change the way I do my clinical practice.
    3. I do not know.

11. **Do you think that knowing the costs related to your clinical practice influences the way you carry out your clinical practice?**
    1. Yes, knowing the costs influences the way I do my clinical practice.
    2. No, knowing the costs doesn't change the way I do my clinical practice.
    3. I do not know.

12. **Would you be willing to have the outcomes and costs of your clinical practice continuously monitored and compared to the performance of other physicians?**
    1. Not willing
    2. Willing if there was clarity of individual benefit
    3. Willing if there was clarity of collective benefit
    4. Willing if data were anonymous

13. **Would you be willing to share data related to the outcomes (outcomes) and costs of your clinical practice for the benefit of cost reduction and improvement in the quality of healthcare?**
    1. Not willing
    2. Willing if there was clarity of individual benefit
    3. Willing if there was clarity of collective benefit
    4. Willing if data were anonymous

14. **Would you be willing to be evaluated and ranked against other physicians by patients?**
    1. Not willing
    2. Willing
    3. Willing if data were not released to the public
    4. Willing if there was a way to assess extreme opinions before release it to the public

15. **Do you know the formula that defines "Value" developed by Porter and Teisberg (2006)?**
    1. Yes
16. Check the components of Porter's "Value" formula, which defines the Value-Based Healthcare components:

<table>
<thead>
<tr>
<th>Numerator (check one)</th>
<th>Denominator (check one)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td></td>
</tr>
<tr>
<td>Price</td>
<td></td>
</tr>
<tr>
<td>Outcomes</td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td></td>
</tr>
<tr>
<td>Expectation</td>
<td></td>
</tr>
<tr>
<td>Benefits</td>
<td></td>
</tr>
<tr>
<td>I do not know</td>
<td></td>
</tr>
</tbody>
</table>

17. How important do you think it is to discuss Outcomes, Costs, Compensation Systems and Value-Based Health Care (VBHC) during graduation?

<table>
<thead>
<tr>
<th></th>
<th>1 - Irrelevant</th>
<th>2 - Not very important</th>
<th>3 - Important</th>
<th>4 - Very Important</th>
<th>5 - Fundamental</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcomes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Payment systems</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>VBHC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

18. Are you familiar with the functioning of the different compensations models for health services practiced in Brazil? Check all that you think are familiar.

- **Payment by global budget**: The hospital receives a fixed annual fee, generally based on the history of the volume of care and the complexity of the services offered. This model predominates in public hospitals. The model may include penalties (deductions) based on pre-agreed indicators.

- **Payment by global adjusted budget**: Similar to the item above, but includes the possibility of period adjustments, generally every 3 or 4 months, based on volume, complexity and pre-agreed indicators that define a penalty or bonus,

- **Payment for service - "open account" (Fee-for-service)**: The provider (hospital, laboratory or doctor) receives for each service provided, regardless of the result obtained with the treatment,
-Payment for care - "procedure packages" or "managed procedures" (Fee-for-service): The provider (hospital, laboratory or doctor) receives per a package that includes services directly linked to the care provided and excludes other care that may be provided due to complications or complications. These extra items are charged "Out of the package"

-Payment for care - "inpatient global per diem" (Fee-for-service): The hospital receives a single fee for a set of services negotiated between the parties, which includes daily rates, most nursing procedures, gas therapy, use of equipment, etc.,

-Episode Bundles: The provider receives a single fee per episode of care, including diagnostic evaluation, hospitalization for the performance of procedures and the post-discharge period, including guaranteeing coverage of complications related to the procedure for a predetermined period and performance guarantee that may generate bonuses or penalties based on pre-defined indicators.,

-Payment by Related Diagnostic Groups (DRG or similar): The provider receives based on the classification of each case by diagnostic grouping. The DRG gives a different weight according to a set of clinical conditions and procedures performed. Ex: A patient who is hospitalized with a myocardial infarction and has diabetes and kidney failure has a lower weight than a patient without the last 2 conditions, therefore, the remuneration of the first will be higher.

-Payment per Capitation: Provider receives a defined value for each registered person assigned to it, for a period of time, regardless of the services that will be used by each person.,

-Payment for Performance, P4P: The provider receives remuneration according to the performance presented in the pre-defined indicators. Ex: P4P for Diabetes: A basal remuneration is defined and a bonus will be assigned according to the number of patients with glycated hemoglobin < 7.

-I am not familiar with any of the compensation models.

---

**Student and University Profile**

19. What is your full name?

20. How old are you in years?

21. What is your gender?
   - Male
   - Female
   - Others

22. Where do you study medicine (University and Local)? Ex: USP - Ribeirão Preto/SP

23. What year of college are you in? Write in years, between 1-6

24. What is your registration number?

25. Does your college have any mandatory subject in Health Management?
   - Yes
   - No
   - No, but it has an optional class
   - I do not know

26. If you answered "YES" in the previous question: Throughout this mandatory subject of Health Management, is the theme of Health Compensation Systems discussed?
   - Yes
   - No
   - I do not know

27. Does your college usually offer lectures, symposia or other complementary training on Health Management topics?
   - Yes
   - No
   - I do not know

28. During graduation at your university, does any chair discuss Health Systems? (SUS, NHS...)
   - Yes
   - No
29. Does your university have an Academic Club of Health Management?
   Yes
   No
   I do not know

30. Does your university have a Junior Medical Enterprise?
   Yes
   No
   I do not know

31. What is your university's teaching methodology?
   Traditional
   Problem-Based Learning
   Team-Based Learning

32. Did you complete another undergraduate degree before medicine? If the answer is "YES", which one(s)?
   Open question

33. What areas do you intend to pursue in medicine?
   Clinical
   Surgery
   Management
   Research
   Radiology
   I do not know

34. What training do you intend to do in addition to a medical degree?
   Residency
   Master's/Doctorate
   MBA
   I do not intend to carry out any of these

35. Do you participate or have participated in any extracurricular activities? Which ones?
   Academic Clubs
   Academic, Athletic Center/Directory
   AEMED, DENEM, IFMSA, COUNCILS, UNIONS
   Junior enterprises
   Startup
   NGOs
   I do not participate in any extracurricular activities

36. Do you have any interests other than medical care?
   Research
   Innovation
   Patient safety
   Quality
   Health Economics
   Artificial intelligence
   Health policies
   No interest beyond medical care