Abstract
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As innovation transforms the healthcare industry, medical institutions are increasingly incorporating business skills and concepts into their curricula. The goal of this study was to characterize the types of students who engage in these supplemental curricula with respect to four entrepreneurial characteristics: entrepreneurial interest, support, confidence, and intention. We sampled students participating in a healthcare Innovation Summit using a validated survey to assess these characteristics. The sampled population reported significantly positive Interest and Support regarding an entrepreneurial career (5.18 and 5.80; p-values <0.01), whereas Intention and Confidence did not significantly differ from neutral (4.02 and 3.78; p>0.05). There were significant positive correlations between individuals' entrepreneurial Interest and all other characteristics; demonstrated by Pearson's Correlation Coefficients of 0.74, 0.62, and 0.59 when comparing sample means of Interest versus Intention, Confidence, and Support, (p-values <0.05). In addition, significant correlation between Intention and Confidence was observed (Pearson's R = 0.78: p-values <0.05). Conversely, sample means for entrepreneurial Support were not significantly correlated with either Intent or Confidence (p-values >0.05).

Our findings supply foundational data for understanding the growing cohort of individuals engaging in entrepreneurial-medicine. These data demonstrate the integrated nature of various entrepreneurial characteristics in these populations and support the idea that
investment, which promotes one area, would translate to increases in others.

**Keywords**
Medical education, Entrepreneurship education, Healthcare innovation, Innovation curriculum

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Introduction

The growth of digital health innovations, rapid advances in personalized medicine, and new frontiers for biotechnology are disrupting the way healthcare is being practiced and impacting all areas of the industry. In 2017 alone, worldwide investments in digital health surpassed $11.5 Billion, up from $8.2 Billion in 2016 (Hanin P.; Dordai 2018). In order for physicians to engage with these rapid innovations in the healthcare ecosystem, both medical schools and healthcare industry professionals realize the need for physicians to supplement their clinical knowledge with skills and techniques from the business sector (Gonzalo et al. 2017). Current medical trainees also seem to realize this need and desire to improve their entrepreneurial skill sets, as demonstrated by a recent survey of 1,299 medical students at 18 US medical schools where nearly two thirds (65.2%) of students reported being interested in learning more about the business aspects of medicine (Wanke et al. 2015).

One way to receive this medical-entrepreneurship training is through MD-MBA combined degree programs, and the number of such programs in the US has increased dramatically in recent decades, from less than 10 in 1993 to over 60 today (Goyal et al. 2015). These combined-degree programs come with caveats - namely, additional years and tuition on top of students’ already long and expensive medical training. In an effort to better equip future physicians to solve healthcare’s complex problems without pursuing an additional professional degree, medical institutions are redesigning their curricula to allow students to learn about innovation and entrepreneurship alongside their medical education. In fact, at least 13 US allopathic medical schools have developed innovation and entrepreneurship programs to teach medical students about business, entrepreneurship, leadership, and technology as a supplement to their core clinical curriculum (Niccum et al. 2017). Furthermore, several medical schools such as Rutgers-Robert Wood Johnson Medical School, University of Michigan Medical School and University of Pennsylvania’s Perelman School of Medicine have student-led organizations that create programming and experiential opportunities for medical students to learn about medical entrepreneurship.

A common type of teaching event used in these entrepreneurial curricula is a day-long “Innovation Summit.” These events bring together leaders from different fields of healthcare innovation to lecture on their area of expertise and describe the steps they took to bring their innovation to market. Throughout the day, participants engage with these speakers and are taught entrepreneurial techniques through panel and round table discussions, question & answer sessions, and skills seminars. Additionally, these summits may include opportunities for participants to interact with other attendees in workshops where they directly apply the basic business techniques they have learned in the preceding lectures. In this way, Innovation Summits and similar events are designed to simultaneously teach students entrepreneurial skills, impassion them to become healthcare innovators, and foster support networks of like-minded students and collaborators.

While these Innovation Summits and similar entrepreneurial curricula are becoming increasingly infused into healthcare training, there is a substantial gap in foundational knowledge about the types of students who attend these events and their sentiments regarding various aspects of entrepreneurship. Not only is this information critical to the success and improvement of these programs, but also such knowledge would enable tailoring of the agendas and material delivered at these events to best foster the entrepreneurial characteristics of the attending audience.

In addition to informing proper curriculum event structure and planning, identifying specific characteristics of these students provides evidence-based knowledge that institutions and educators need in order to advocate for public and private funding to further sustain and enhance these programs. As a result, data demonstrating that students are actively interested in entrepreneurship and innovation can bolster the rationale for universities, local and regional governments, and private investors to support entrepreneurial students and drive innovation forward. These data also have the potential to illuminate self-identified weaknesses in attendees’ expectations of success, such as knowledge, support, or confidence, which could then be targeted in future events.

Finally, this collected attendee data, particularly demographics data, can facilitate identification of any disparities between groups participating in these events. This, in turn, can highlight opportunities to promote entrepreneurial interest across student communities to help bolster diversity in the entrepreneurial-medicine sector.

In this research, we attempted to address this knowledge gap by quantifying the entrepreneurial characteristics of students participating in a medical entrepreneurship curriculum event. To our knowledge, this is the first study that addresses these questions. As such, this study provides important foundational insights and serves as a baseline metric for future ‘trend’ studies analyzing the entrepreneurial features of similar student populations over time.

Purpose

The following study aimed to assess specific entrepreneurial characteristics of undergraduate and graduate healthcare student participants of a medical innovation and entrepreneurship curriculum event. Our goal was to better understand the
types of individuals who are attracted to such programming, their current intent to pursue a career involving entrepreneurship, and their sentiment toward various entrepreneurial characteristics (e.g. entrepreneurial interest, support, intent, and confidence: terms defined in Methodology).

Our intention is to facilitate understanding of these students’ characteristics and their relationships to each other (e.g. do certain entrepreneurial characteristics trend together?). Ideally, these insights will enable institutions to 1) better tailor entrepreneurship curricula to support the characteristics of individuals that participate in these events 2) encourage further grant funding and support to foster these entrepreneurial characteristics in their students and 3) promote interest in medical entrepreneurship across diverse student groups. Furthermore, given this study’s objective as a foundation for future investigations into entrepreneurial trends in similar populations, we assessed whether the four entrepreneurial metrics measured here were sufficient to capture the entire entrepreneurial landscape of the sampled population. These data will help to inform whether future studies should include additional measurement metrics.

We conducted this study by surveying participants of the Rutgers Biomedical Entrepreneurship Network Healthcare Innovation Summit, an event that is part of the supplemental entrepreneurial-medicine curriculum at Rutgers-Robert Wood Johnson Medical School. The event was open to the public and attracted 123 attendees, of which 59 were medical, graduate, and undergraduate students. We hypothesized that the students participating in this event would exhibit significantly positive levels of interest, confidence, support, and intent of engaging in entrepreneurial careers.

Methods
Setting
The BEN Healthcare Innovation Summit was a one-day event open to the public featuring keynote presentations from industry professionals on topics including the latest innovations in healthcare delivery, insurance, medical education, telemedicine, biotechnology, health information technology, and healthcare venture capital. The event included an experiential learning workshop accompanied by small-group, roundtable discussions. The Innovation Summit took place on Saturday, April 1, 2017 in The Arline & Henry Schwartzman Courtyard at Robert Wood Johnson University Hospital in New Brunswick, New Jersey.

Population
Participants of this Rutgers IRB-approved survey-based study consisted of registrants for the Innovation Summit. Potential respondents were screened for eligibility at the start of the survey. In order to be eligible to complete the study, participants had to be registered to attend the summit and currently enrolled as an undergraduate or graduate student within New Jersey. Participants were not compensated for their response. The final sample consisted of 21 undergraduate and graduate students.

Recruitment and Data Collection
Participants were invited to partake in the survey during the online registration process. After registering for the event, individuals were redirected to a description of the survey and provided with a link to access the survey instrument. This link was also provided at check-in on the day of the event to qualifying attendees. These eligible conference attendees could opt to take the survey via an iPad at the registration table on the day of the conference or on their own personal device.

Survey Questionnaire
We used a survey instrument developed and validated for assessing entrepreneurial features by do Paco et al (do Paço et al. 2011) to assess the following four characteristics:

a. **Entrepreneurial Interest**: a respondent’s attitude and orientation towards a future entrepreneurial career.

b. **Support Network**: a respondent’s impression of the support/approval they would receive from people in their close environment if they pursued an entrepreneurial career.

c. **Entrepreneurial Confidence**: a respondent’s confidence in their own entrepreneurial capacity, skills, and knowledge-base.

d. **Entrepreneurial Intention**: a respondent’s intention to become an entrepreneur.

The complete survey questionnaire can be found in Appendix 1. For each survey question, respondents could select one of seven Likert Scale values describing their agreement with a pro-entrepreneurial statement ranging from 1 (complete
disagreement/negative sentiment) to 4 (neutral) to 7 (complete agreement/positive sentiment). These scales meet adequate measures for composite reliability and discriminant validity (do Paço et al. 2011), and thus provide an accurate assessment of the entrepreneurial characteristics of the population sample surveyed here.

Data Analysis:
All data analyses were performed using MATLAB (Mathworks, Natwick MA) and Excel (Microsoft, Redmond WA). Multiple survey questions addressed the same entrepreneurial characteristics, so respondents’ individual question scores were binned for each characteristic and the mean value calculated, resulting in a single summary score of 1-to-7 for each of the four entrepreneurial characteristics per respondent. Linear regression models comparing entrepreneurial characteristics were built using a least-squares fit. For multiple regression models all $R^2$ coefficients of best fit were adjusted to account for the multiple predictor variables.

Declaration of Interest:
The authors report no declarations of interest.

Results/Analysis
In total, 21 surveys were received from the 77 eligible Innovation Summit participants. Two of these questionnaires were removed due to incomplete response, resulting in 19 completed surveys for analysis and a response rate of approximately 25%. A complete description of survey respondent demographics is presented in Table 1. Multiple ages, sex, marital status, education levels, and ethnicities were represented with a majority of respondents reporting as 21-to-25 year-old, single, Caucasian, male medical students.

A complete list of the mean and standard deviation of responses to individual survey questions can be found in Appendix 2. Figure 1 depicts the distribution of summary sentiment scores for each of the four combined entrepreneurial domains:

| Table 1. Demographic Information |
|----------------------------------|
| Age                              | Response |
| 18 to 20                         | 1 (6%)    |
| 21 to 25                         | 13 (68%)  |
| 26 to 30                         | 5 (26%)   |
| Sex                              | Response |
| Male                             | 13 (68%)  |
| Female                           | 6 (32%)   |
| MaritalStatus                    | Response |
| Single                           | 14 (74%)  |
| Engaged                          | 2 (11%)   |
| Married                          | 3 (15%)   |
| EducationLevel                   | Response |
| Medical Student                  | 16 (84%)  |
| Undergraduate                    | 2 (11%)   |
| Masters Student                  | 1 (5%)    |
| Ethnicity                        | Response |
| Caucasian                        | 10 (53%)  |
| Asian/Pacific Islander           | 6 (32%)   |
| Hispanic/Latino                  | 0         |
| African American                 | 0         |
| Native American/Alaskan Native   | 0         |
| Prefer Not to Answer             | 3 (15%)   |
Interest, Support, Confidence, and Intent. Overall, most characteristics had relatively wide score distributions, with all except Support containing both negative and positive sentiment values. Support had both the smallest distribution range (whisker-to-whisker: black dotted lines) and interquartile range (IQR: blue box) with values of 3 and 1.17 respectively. Intention had both the largest distribution and IQR at 6 and 2.25, respectively. A complete set of summary statistics can be found in the corresponding table of Figure 1.

The sampled population of Innovation Summit participants reported a significantly positive Interest and Support sentiment towards an entrepreneurial career, calculated by one-sample t-tests comparing each characteristic’s mean score to a null hypothesis value of 4 (neutral sentiment). The mean Intention was near-neutral at 4.02. The mean Confidence sentiment score was slightly negative at 3.78, but did not significantly differ from neutral.

Next, we performed simple linear regression analyses to better understand the relationship between entrepreneurial characteristics. Specifically, we made comparisons between each of the six possible pairs of characteristics to identify possible trends between scores. Figure 2 depicts the resulting analyses.

Individuals’ entrepreneurial Interest was significantly positively correlated with all three other characteristics; demonstrated by Pearson’s Correlation Coefficients of 0.74, 0.62, and 0.59 when comparing sample means of Interest versus Intention, Confidence, and Support, respectively (p-values <0.05). In addition, significant correlation between Intention and Confidence was observed (Pearson’s R = 0.78: p-values <0.05). Conversely, sample means for entrepreneurial Support were not significantly correlated with either Intent or Confidence (p-values > 0.05).

As discussed above, the primary focus of our analyses was to measure the relative distribution of sentiment regarding four entrepreneurial characteristics in Innovation Summit participants and assesses correlations between these characteristics, objectives accomplished above in Figures 1 and 2. However, as shown in Figure 2 the adjusted R-squared values for these pairwise comparisons were relatively low, which indicates that simple bivariate linear models were not sufficient to accurately capture the observed variability in the data. As such, a secondary analysis was performed to determine if, collectively, the variables surveyed in this study accurately captured the variability in the widely distributed and neutral-centered Confidence and Intention distributions, or whether additional variables may need to be assessed in future studies. Multiple linear regression analyses were performed, modeling Confidence and Intent each as functions of the remaining three variables (Figure 3). These multiple regression models more accurately captured the observed variability in Intention and Confidence with resulting adjusted R-squared values of 0.66 and 0.55, respectively.

**Figure 1. Evaluation of Entrepreneurial Characteristics**

Top: Box plot depicting distributions of sample means for each of the four surveyed entrepreneurial characteristics. On each box, the central red line indicates the median; top and bottom edges of the blue box indicate the 25th and 75th percentiles, respectively; top and bottom whiskers extend to the max and min samples, respectively. Asterisks denote characteristics where mean sentiment scores of the population differed significantly from neutral (score of 4). P-values <0.05, one sample t-test.

Bottom: Tabular depiction of summary statistics for the sample means of each characteristic.
Discussion
As innovation and entrepreneurship continue to transform healthcare, medical institutions are increasingly incorporating business skills and knowledge into their curricula. The goal of this study was to understand the types of students that engage in these curricula by assessing the entrepreneurial characteristics of students participating in a business and healthcare innovation summit.

Figure 2. Simple Linear Regression Modeling and Correlation Analysis of Entrepreneurial Characteristics. Plots depict pairwise comparisons between characteristics (blue data points); red lines denote the linear best fit of each data set. Asterisks denote comparisons where characteristics were significantly correlated. P-values < 0.05, paired t-test.
As suggested by the total number of attendees at the event (123 people), passive interest in medical-entrepreneurship likely exists amongst students, faculty, and other members of the healthcare industry. Almost 50% of these attendees were undergraduate, graduate, or medical students; data that underscores the increasing interest in entrepreneurship in these populations which has been well-documented in previous studies (Wanke et al. 2015).

Given that these students were participating in a voluntary, supplemental entrepreneurial curriculum event, we hypothesized that the sampled population would exhibit significantly positive mean responses for all four measured entrepreneurial characteristics. However, this was not the case. Rather, while respondents reported significantly positive attitudes towards a future entrepreneurial career (e.g. Interest) and perceived positive support from their community and peers for entrepreneurial pursuits (e.g. Support), they were neutral regarding both their Confidence in their entrepreneurial abilities and Intention to pursue an entrepreneurial venture (Figure 1).

It is important to acknowledge the significant, positive relationship between entrepreneurial Interest with each of the other characteristics (Figure 2). This suggests that as one would expect - overall excitement towards entrepreneurship is critical to a student’s confidence, perceived support, and intention towards an entrepreneurial pursuit. Conversely, the lack of significant correlations between Support and Intention or Support and Confidence suggests that peer and faculty support alone is not sufficient to engage these students in entrepreneurial pursuits. Rather, our results suggest there’s likely a complex interplay between an individual’s various entrepreneurial characteristics. Taken together, these data imply that multi-faceted curricula targeting multiple domains of entrepreneurship (such as Innovation Summit-type events) may be the most effective means of fostering innovative pursuits in these populations.

The results of this study provide foundational data for institutions and medical educators advocating for grant funding for supplemental medical-entrepreneurship curricula. The significantly positive Interest and Support in this sample (Figure 1) suggests that there is indeed a strong community of students who are actively interested in learning more about healthcare innovation (e.g. the attendee ‘Demand’ for these events is substantial). These results combined with the neutral Confidence and Intention data suggest that there are actionable opportunities for administrators, policy makers, and educators to fulfill this demand and foster innovation. For example, the significantly positive correlation between Confidence and Intent (Figure 2) suggests that curricula designed to improve entrepreneurial confidence through skills workshops and seminars may, in-turn, increase student intent in pursuing innovative healthcare ventures. Furthermore, grant support for worthy educational experiences can encourage students to actively seek out additional experiences, courses, and self-directed learning in fields that drive their individual entrepreneurial curiosity and interest. Additionally, institutional support through scholarships and establishment of physical space for laboratories, incubators, and accelerators can aid in removal of financial barriers and promote a culture of innovation. Moreover, public and private academic institutional support for these Innovation Summit-type events provides a venue for participants to build their skills sets, test their innovative ideas, and network within a like-minded community.
A secondary goal of this work was to provide baseline metrics for future studies investigating trends of entrepreneurial characteristics in similar populations over time. As such, it is important to consider whether the metrics measured here sufficiently captured the entrepreneurial profile of the sampled population, or whether future studies should investigate additional metrics. The results of Figure 3 show that combined, all the variables measured in this study result in linear models of Intention and Confidence with adjusted R squared values of 0.66 and 0.55, respectively. While these values are a marked improvement in captured variability compared to the simple pairwise linear regression models of Figure 2, they are still relatively low. One explanation is that this is because a simple linear model is not the best fit for the system at hand, which would warrant additional, more sophisticated analyses of larger data sets.

Alternatively, these results may suggest there are additional characteristics that were not accounted for in this study. As such, we would suggest that future studies include more detailed and segmented entrepreneurial metrics, perhaps by adding additional specific questions regarding each characteristic (for example: subcategories of confidence regarding different genres of entrepreneurial skills, such as securing funding, building a team, finding mentors, etc.).

The results of this work set a foundation for numerous additional studies. In particular, it would be worthwhile to capture direct measurements of the utility of Innovation Summit-type curricula by investigating how they affect entrepreneurial characteristics of participants. Such a study could be accomplished with a pre-and-post event survey using similar data collection methods to those in this study and would likely provide valuable information regarding how to best improve and tailor these events in the future. Similarly, an in-depth comparison between different types of entrepreneurial-medicine curricula (e.g. Innovation Summits, vs. Classroom Lectures, vs. other teaching modalities) would help to inform medical educators about the most effective curriculum structures as well as provide more appropriate and actionable analysis of this unique entrepreneurial population. Additionally, continued demographic assessments at these events may help inform how well they are being marketed to - and connecting with - different student groups. Furthermore, studies investigating trends in entrepreneurial characteristics of a cohort of students who participate in multiple curricular events over time would likely produce useful and informative data about the role these events play in fostering entrepreneurial features.

Limitations

This study is subject to potential limitations. Small sample size may have led to type II error, resulting in an inability to parse results by demographics or education level (e.g. graduate, medical, undergraduate) as well as an inability to look for significant difference in entrepreneurial characteristics between groups. Also, the largest subset of the sampled population was medical students. Despite the seemingly apparent increase in entrepreneurship amongst graduate, medical, and undergraduate healthcare students alike, medical students are less likely to have a primary and immediate goal of starting a company given the prospect of residency training after graduation. This may have biased responses to questions such as “My professional goal is to become an entrepreneur,” and lowered the mean Intention category score (Appendix 2).

Related to this, an additional limitation is the choice of instrument used in this study, which was developed and validated in a class of secondary students without a healthcare focus. The Biomedical Entrepreneurship Network provides a monthly speaker series and workshops that focus on the fundamentals of entrepreneurship, covering core business concepts such as accounting, finance, economics, etc. Although these lessons are delivered in the context of healthcare entrepreneurship, they are not dependent upon this context. Similarly, this instrument was utilized, because it was validated to broadly assess entrepreneurial characteristics in students. However, since the respondent pool was ultimately comprised almost entirely of medical students, this may have been a missed opportunity to modify this instrument or develop a novel instrument to better assess these characteristics in this unique population.

In addition, results from this study may be difficult to generalize more broadly to students in different regions or in different, non-healthcare educational trajectories since respondents were exclusively registrants of a single Innovation Summit, which took place at a medical institution in New Jersey, United States. Furthermore, sampling bias must be considered given that eager entrepreneurs who registered for the event may have been more likely to participate in the study due to their overall passion for the subject.

While the sample population in this study was relatively small, it is important to note that the reported demographics were considerably skewed towards early-to-mid twenties, Caucasian, males. Greater diversity of backgrounds and ideas is critical for maximal innovation in healthcare. Thus, observing similar trends in future studies would warrant additional research investigating the cause of these skewed demographics. Further demographic studies showing similar skews in
age, race, and gender would warrant advocacy for additional funding and support of initiatives that encourage entrepreneurial interest across diverse student populations.

Conclusion
In this study we sought to quantify, for the first time, the entrepreneurial characteristics of healthcare undergraduate and graduate students participating in a entrepreneurial-medicine curriculum. Our findings constitute a leadoff point in further growing an existing culture of healthcare innovation and entrepreneurship in these student populations. These data also demonstrate the integrated nature of these characteristics, supporting the idea that curricula that promote one area, for example Confidence, would translate to increases in others such as Intent. As such, these data can help medical educators develop and implement targeted materials that best equip and inspire these students to become medical innovators. Opportunities for expansion on the findings of this study are substantial and could detail trends within the larger entrepreneurial-medicine environment.

Take Home Messages
- To make entrepreneurial-medicine instruction effective, medical educators must tailor these curricula to the entrepreneurial attitudes of students. As such, medical educators must be knowledgeable of the types of students that participate in these curricula.
- Healthcare students participating in a medical-entrepreneurship curriculum demonstrate significant Interest in an entrepreneurial career and perceive positive Support from their community and peers for entrepreneurial pursuits, yet are neutral in their Confidence and Intent to pursue an entrepreneurial venture.
- Entrepreneurial Interest was significantly, positively correlated with all three other characteristics (Intention, Confidence, and Support). This suggests curricula-based efforts that foster Interest can bolster Confidence and Intent.
- Confidence and Intent are also positively correlated, suggesting that curricula designed to improve entrepreneurial Confidence through skills workshops and seminars may, in turn, increase student Intent to pursue innovative healthcare ventures.

Notes On Contributors
1. Alexander Watson: Alexander Watson is a medical student at Rutgers-Robert Wood Johnson Medical School (R-RWJMS) and a Rutgers Business School MBA graduate. He was president of the Biomedical Entrepreneurship Network (BEN) from 2016-2017 and contributor to the development of the Distinction in Medical Innovation and Entrepreneurship (DiMIE) at R-RWJMS.

2. Camden MacDowell: Camden MacDowell is a MD-PhD combined degree candidate at Rutgers-Robert Wood Johnson Medical School and Princeton University. He was on the executive board of the Biomedical Entrepreneurship Network (BEN) from 2016-2017 and also contributed to development of the Distinction in Medical Innovation and Entrepreneurship (DiMIE) at R-RWJMS.

3. Gregg Khodorov: Gregg Khodorov is a medical student at Rutgers-Robert Wood Johnson Medical School (R-RWJMS) and a Rutgers Business School MBA graduate. While Co-President of the Biomedical Entrepreneurship Network (BEN), Gregg coordinated and planned the first-ever BEN Health Innovation Summit, and served as a moderator for a panel on redesigning payer-provider models.

4. Julia Tartaglia: Julia Tartaglia is a medical student at Rutgers-Robert Wood Johnson Medical School. She has conducted research in sleep and cognition at the BIDMC Center for Sleep and Cognition. Julia served as co-President of the Biomedical Entrepreneurship Network and co-director of the BEN Health Innovation Summit.

5. Paul Weber, MD, RPh, MBA: Dr. Paul Weber is a licensed physician, pharmacist and MBA graduate with experience in academia, currently as an Associate Dean for CME at Rutgers-Robert Wood Johnson Medical School, Director for the Health Systems Science Curriculum Thread, and as an educator.
Appendices

Appendix 1: Survey Questions

Entrepreneurial Intention
Indicate your level of agreement with the following sentences from 1 (total disagreement) to 7 (total agreement).

a. Being an entrepreneur implies more advantages than disadvantages to me
b. A career as entrepreneur is attractive for me
c. If I had the opportunity and resources, I’d like to start a firm
d. Being an entrepreneur would entail great satisfactions for me
e. Among various options, I would rather be an entrepreneur

Entrepreneurial Support Network
If you decided to create a firm, would people in your close environment approve of that decision? Indicate from 1 (total disapproval) to 7 (total approval).

a. Your close family
b. Your friends
c. Your colleagues

Entrepreneurial Confidence
To what extent do you agree with the following statements regarding your entrepreneurial capacity? Value them from 1 (total disagreement) to 7 (total agreement).

a. To start a firm and keep it working would be easy for me
b. I am prepared to start a viable firm
c. I can control the creation process of a new firm
d. I know the necessary practical details to start a firm
e. I know how to develop an entrepreneurial project
f. If I tried to start a firm, I would have a high probability of succeeding

Entrepreneurial intention (EI)
Indicate your level of agreement with the following statements from 1 (total disagreement) to 7 (total agreement).

a. I am ready to do anything to be an entrepreneur
b. My professional goal is to become an entrepreneur
c. I will make every effort to start and run my own firm
d. I am determined to create a firm in the future
e. I have very seriously thought of starting a firm
f. I have the firm intention to start a firm some day
Appendix 2: Individual Question Answers

| Characteristic | Question                                                                 | Mean | SD  |
|----------------|--------------------------------------------------------------------------|------|-----|
| Interest       | Being an entrepreneur implies more advantages than disadvantages to me.  | 5.58 | 1.22|
| Interest       | A career as an entrepreneur is attractive for me.                        | 5.37 | 1.67|
| Interest       | Being an entrepreneur would entail great satisfaction for me.            | 5.53 | 1.58|
| Interest       | Among various options, I would rather be an entrepreneur.               | 4.42 | 1.61|
| Support        | Your close family                                                        | 5.79 | 0.92|
| Support        | Your friends                                                             | 5.89 | 1.05|
| Support        | Your colleagues                                                          | 5.74 | 1.24|
| Intention      | I am ready to do anything to be an entrepreneur.                         | 4.16 | 1.21|
| Intention      | My professional goal is to become an entrepreneur.                       | 3.37 | 1.38|
| Intention      | I will make every effort to start and run my own firm.                  | 4.16 | 1.54|
| Intention      | I am determined to create a firm in the future.                         | 3.26 | 1.73|
| Intention      | I have very seriously thought of starting a firm.                        | 4.00 | 1.97|
| Intention      | I have the firm intention to start a firm some day.                     | 4.11 | 1.29|
| Confidence     | To start a firm and keep it working would be easy for me.               | 3.74 | 1.76|
| Confidence     | I am prepared to start a viable firm.                                   | 3.58 | 1.98|
| Confidence     | I can control the creation process of a new firm.                       | 3.68 | 1.77|
| Confidence     | I know the necessary practical details to start a firm.                 | 4.16 | 1.98|
| Confidence     | I know how to develop an entrepreneurial project.                        | 4.47 | 2.14|
| Confidence     | If I tried to start a firm, I would have a high probability of succeeding. | 4.26 | 1.94|

Declarations
The author has declared that there are no conflicts of interest.

Ethics Statement
This study was conducted under the supervision of the Rutgers HealthSci Institutional Review Board, Pro20170000012.

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This article has not had any External Funding

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Trevor Gibbs
AMEE

This review has been migrated. The reviewer awarded 4 stars out of 5

Not having reviewed the first paper, I did before I reviewed this second version. I enjoyed reading both and I think that the authors have addressed the concerns from the first review. Although I found the paper well written and important, I was at a slight loss to know if the authors confused somewhat the issues of innovation and entrepreneurialism, especially when applied to medical education and medical student development. I find students incredibly innovative in their thinking and doing and find that this is frequently knocked out of them during medical school, just as simple curiosity is. Not detracting from this issue however, I did feel that this was a paper that should be read by all curriculum developers.

Competing Interests: No conflicts of interest were disclosed.

Reviewer Report 14 March 2019

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Richard Hays
James Cook University

This review has been migrated. The reviewer awarded 4 stars out of 5

While I found this paper (and the original version) to be fascinating, two issues detract from its value. The
first is that entrepreneurialism is a broad concept, yet this focus here is on a starting up a business. I am not sure that this captures adequately the scope for innovation and creative development within existing organisations (including the huge public health sector). The second concern is the low response rate, which limits severely any interpretation. However, medical educators need to think more about the concepts of innovation and development, as several registration bodies used similar terms to describe helping medical graduates achieve learning outcomes that shape the future and solve problems in the health care system.

**Competing Interests:** No conflicts of interest were disclosed.

**Reviewer Report 10 February 2019**

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**Ken Masters**
Sultan Qaboos University

This review has been migrated. The reviewer awarded 4 stars out of 5

This is a really useful article that addresses the business side of healthcare; an area often ignored in curricula, and - from personal experience with medical students – is often seen as less important than other components, especially clinical components. The authors have addressed the previous reviewer’s criticisms adequately. Pointedly, they have acknowledged the lost opportunity to develop a more direct tool aimed at medical students, but have also shown that, in balance, the tool was reasonably suitable to the purpose. It would be encouraging if the authors elected to take this further, develop a new tool, and then repeat the study with a new group of students. Their results, I am sure, would prove invaluable.

**Competing Interests:** No conflicts of interest were disclosed.

**Version 1**

**Reviewer Report 20 August 2018**

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This review has been migrated. The reviewer awarded 3 stars out of 5

This is a fascinating article which is very timely in the current health care climate. I read it with interest and think that the authors have done a nice job surveying participants in the healthcare Innovation Summit about aspects of entrepreneurship. However, the major barrier I see is the use of a survey instrument which is validated only in the business world and meant for those who intend careers in business (not medicine). Further discussion below:

Abstract: Some of the wording was awkward such as “significantly positively correlated” and could be rewritten as, “There were significant positive correlations between X and Y....”. Introduction: This was extremely well-worded and very helpful by way of background – both why the authors are interested in the topic as well as a good explanation of the Innovation Summit structure. May wish to include a brief discussion of the Millennial learner and how business/entrepreneurship are well-suited for the Millenial generation.

Methodology: My major criticism is that the “validated” tool the authors use has been validated only in the business world and many of the questions do not seem applicable to those in medicine. The authors mention this as a limitation of the study, but my question is: why did the authors not rewrite/reframe/reword some of the questions to create their OWN survey tool which would be the first of its kind for assessment in medicine? I personally think that creation of a survey tool and piloting it with this group then provides the framework for validation in future studies and gives the authors real credibility as innovators in this area. I would much prefer to see modification of a validated tool – even if the study results presented here are not “validated” – than reliance on a tool that is not directly applicable to most medical practitioners.

Discussion: This was nicely written and the point about institutional funding to allow promotion of a culture of innovation is well made. The standard limitations of small sample size, homogeneous population etc were appropriately addressed. However, the main point remains the lack of generalizability as I discussed above due to the business focused nature of the validated tool used for assessment. The authors should call for creation of a healthcare-entrepreneurial assessment tool and then create it themselves. This paves the way for future career development/opportunities in this area.

**Competing Interests:** No conflicts of interest were disclosed.