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Industry-academic partnerships: an approach to accelerate innovation

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ABSTRACT

Background: Biotechnology companies are process-driven organizations and often struggle with their ability to innovate. Universities, on the other hand, thrive on discovery and variation as a source of innovation. As such, properly structured academic-industry partnerships in medical technology development may enhance and accelerate innovation. Through joint industry-academic efforts, our objective was to develop a technology aimed at global cervical cancer prevention.

Methods: Our Center for Medical Innovation assembled a multidisciplinary team of students, surgical residents, and clinical faculty to enter in the University of Utah's annual Bench-to-Bedside competition. Bench-to-Bedside is a university program centered on medical innovation. Teams are given access to university resources and are provided $500.00 for prototype development. Participation by team members are on a volunteer basis. Our industry partner presented the validated need and business mentorship. The team studied the therapeutic landscape, environmental constraints, and used simulation to understand human factors design and usage requirements. A physical device was manufactured by first creating a digital image (SOLIDWORKS 3D CAD). Then, using a 3-dimensional printer (Stratasys Objet30 Prime 3D printer), the image was translated into a physical object. Tissue burn depth analysis was performed on raw chicken breasts warmed to room temperature. Varying combinations of time and temperature were tested, and burn depth and diameter were measured 30 min after each trial. An arithmetic mean was calculated for each corresponding time and temperature combination. User comprehension of operation and sterilization was tested via a participant validation study. Clinical obstetricians and gynecologists were given explicit instructions on usage details and then asked to operate the device. Participant behaviors and questions were recorded.

Results: Our efforts resulted in a functional battery-powered hand-held thermocoagulation prototype in just 72 d. Total cost of development was <$500. Proof of concept trials at 100°C demonstrated an average ablated depth and diameter of 4.7 mm and 23.3 mm, respectively, corresponding to treatment efficacy of all grades of precancerous cervical lesions. User

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comprehension studies showed variable understanding with respect to operation and sterilization instructions.

Conclusions: Our experience with using industry-academic partnerships as a means to create medical technologies resulted in the rapid production of a low-cost device that could potentially serve as an integral piece of the "screen-and-treat" approach to premalignant cervical lesions as outlined by World Health Organization. This case study highlights the impact of accelerating medical advances through industry-academic partnership that leverages their combined resources.

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Introduction

Innovation is fundamental to the evolution of surgery benefiting both patients and society as a whole. The management of gallbladder disease, for e.g., illustrates how a single procedure came to define a whole new field of surgery based on laparoscopes, stapling devices, and intra-abdominal instruments, now commonly referred to as minimally invasive surgery. The minimally invasive approach to gallbladder removal has become the standard of care and is associated with fewer complications, shorter hospital stay, and a decreased period of recovery compared with open surgery.[1]

Historically, advancements in the field of surgery have largely been credited to the individual surgeon innovator working within academic medical centers.[2,3] Today, a considerable portion of the research and development related to surgical innovation takes place at academic centers. Broadly speaking, however, academic centers are not adept at generating marketable products from novel technology and innovation.[4] This competence typically falls under the purview of industry, thus collaboration between research institutions and industry functions to make surgical innovations more publically available.

The growth of surgical innovation driven by industry-academic partnerships can largely be attributed to several key policy changes that were implemented in the 1980s.[5] Most notably, the Bayh-Dole Act of 1980 allowed universities, rather than the federal government, to own patents arising from federal research grants.[6] As a result, the United States saw a rapid rise in industry-academic partnerships and today many academic medical centers function as a central hub for fostering entrepreneurial culture through collaboration with private companies.[5,7]

Although critics of industry-academic partnerships often site concerns regarding conflicts of interest, the social benefit that arises from the expeditious dissemination of medical innovation is evident by the significant reductions in cost and time to bring new medical treatments and technologies into clinical use. To illustrate this point, we recount our experience of an industry-academic collaboration focused on creating a low-cost device to ablate precancerous lesions in resource-poor areas.

Methods

As part of the University of Utah's Center for Medical Innovation, Bench-to-Bedside (B2B) is an annual competition whereby student teams form into multidisciplinary startup companies and given the task of identifying an unmet clinical need.[8] These student-led teams have access to university resources and physicians from a broad area of specialties to serve as their consultants, key opinion leaders, and stakeholders. Each team is also paired with an industry mentor. Teams entering the competition are limited to $500 in prototype funding. Participation in the event is on a voluntary basis.[8]

In this particular year, a local medical technology company approached one of the authors with a request to partner with a university team to cocreate and commercialize a technology based on their perceived market need. In response, our Center for Medical Innovation assembled a multidisciplinary team of three graduate and two medical students, two surgical residents and two clinical faculty to enter the 2015 B2B competition held in Salt Lake City, Utah. In this case, our industry partner, Cure Medical LLC, presented the medical need noting that cervical cancer continues to be a major global health burden,[9] especially in resource-poor regions where over 90% of all cervical cancer deaths occur.[9] Our team validated the need through literature searches and stakeholder interviews. After the validation process, we decided to focus on creating a low-cost device able to ablate cervical intraepithelial

Fig. 1 – CINLUMA Cervical Thermocoagulation device. From left to right: CINLUMA device, removable 12 V lithium ion battery, alternate removable thermal probe, recharge docking station for battery, 12 V AC/DC adapter. (Color version of figure is available online.)