The Digital Health Scorecard: A New Health Literacy Metric for NCD Prevention and Care

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ABSTRACT

According to the World Health Organization, 3 out of 5 deaths worldwide are due to common, chronic conditions, such as heart and respiratory diseases, cancer, and diabetes. These noncommunicable diseases (NCDs) are linked to multiple lifestyle risk factors, including smoking, the harmful use of alcohol, and physical inactivity. They are associated with other "intermediate" risk factors, such as elevated body mass index (BMI), hypertension, hyperlipidemia, and hyperglycemia. Taking action to reduce these 7 risk factors can help people protect themselves against leading causes of death. All of these risk factors are measurable and modifiable, but globally available, cost-effective, and easy-to-use outcome metrics that can drive action on all levels do not yet exist. The Digital Health Scorecard is being proposed as a dynamic, globally available digital tool to raise public, professional, and policy maker NCD health literacy (the motivation and ability to access, understand, communicate, and use information to improve health and reduce the incidence of NCD). Its aim is to motivate and empower individuals to make the behavioral and choice changes needed to improve their health and reduce NCD risk factors by giving unprecedented access to global data intelligence, creating awareness, making links to professional and community-based support services and policies, and providing a simple way to measure and track risk changes. Moreover, it provides health care professionals, communities, institutions, workplaces, and nations with a simple metric to monitor progress toward agreed local, national, and global NCD targets.

A total of 57 million deaths occurred worldwide during 2008; 36 million (63%) were due to noncommunicable diseases (NCDs), principally cardiovascular diseases, diabetes, cancer, and chronic respiratory diseases. Nearly 80% of these NCD deaths (29 million) occurred in low- and middle-income countries [1]. Moreover, future prosperity is challenged with a cumulative output loss estimated at $47 trillion over 20 years [2]. In September of 2011, the United Nations (UN) convened a high-level meeting to "address the prevention and control of NCDs worldwide" [3]. Government leaders gathered there endorsed a Political Declaration that called for a wide-ranging set of actions; this is only the second time in history that the UN General Assembly has taken such a global initiative on a health issue (the other being HIV/AIDS in 2000). Building on this Declaration, the World Health Assembly passed a resolution in 2012 calling for an action plan to achieve a global target of a "25% reduction in premature mortality from NCDs by 2025" [4], with multistakeholder response to address modifiable risk factors, targets, and a monitoring mechanism to track progress. The World Health Organization (WHO) Global NCD Action Plan 2013-2020 is to be presented to the World Health Assembly in May 2013. The WHO has identified "best buys" (high impact, lower cost interventions) related to modifiable risk prevention and care. Simple, cost-effective tools to raise awareness and track progress toward the adoption of these "best buys" on both individual and system levels are necessary for curbing the rise of NCDs and preventing further rises in mortality.

KEEPING IT SIMPLE—CHECKLISTS AND SCORECARDS

In their book *Simple: Conquering the Crisis of Complexity*, Alan Siegel and Irene Etzkorn challenge the rise in complexity of our everyday experiences, regarding everything ranging from "tax forms to medicine bottles" [5]. They quote Henry David Thoreau in their urgency to "Simplify, simplify" [5] to meet the ever-demanding complexities of the 21st century. System complexity has been identified as a major "navigational" obstacle and challenge to people's NCD health literacy [6] (the motivation and ability to access, understand, assess, and use information to improve health and reduce the incidence of NCD [7]). Successful approaches to simplification have been adopted in multiple industries (e.g., the airline industry, engineering, construction) with the use of simple tools that have raised awareness of safety and risk issues and thereby saved lives. A checklist is an intuitive, practical, easy-to-use tool that highlights critical actions to be taken [8]. In the medical field, such a tool was used for safe central line placement in intensive care units (ICUs). The incident rate ratio for central line infections in some hospitals was nearly halved by the implementation of this checklist in their ICU [9]. Stemming from this initial work, the WHO

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GLOBAL HEART

VOL. 8, NO. 2, 2013
ISSN 2211-8160
http://dx.doi.org/10.1016/j.gheart.2013.05.006

TABLE 1. Recommendations for preventing chronic disease

	NIH	AHA	Mayo
Maintain blood pressure within normal range	X	X 120/80 mm Hg	X 120/80 mm Hg
Keep proper weight	X	X	X BMI <25
Exercise more	X	X ≥150 min/ week	X ≥150 min/ week
Quit smoking	X	X	X
Eat a healthy diet		X	X
Reduce blood cholesterol		X <200 mg/dl	
Manage diabetes		X	
Limit alcohol to moderate amounts		X	X

NIH, National Institutes of Health; AHA, American Heart Association; Mayo, Mayo Clinic; ACC, American College of Cardiology; HMS, Harvard Medical School; LDL, low-density lipoprotein; HDL, high-density lipoprotein; BMI, body mass index.
Table adapted from Miron-Shatz T and Ratzan S [21].

developed other patient safety checklists, which built upon various industry models. The 90-second Surgical Safety checklist, for example, is a 1-page, 19-item tool, the use of which has led to dramatic reductions in surgery-related complications and deaths [10]. More recently, the WHO has developed a pilot edition of a Safe Childbirth Checklist to address the 2.6 million stillbirths and 3 million newborn deaths that occur each year [11].

A scorecard is similar to a checklist tool in that it lists key components necessary for achieving an overall goal. The difference is that a scorecard yields a score that becomes a standardized metric for users to assess identified conditions on a linear scale. Various expert groups have called for scorecard development in the NCD area. The World Economic Forum (WEF) Global Agenda Council, for example, has identified the NCD epidemic as one of the 4 key global economic threats and has called for the development of a "health and well-being footprint" [2] that serves as a scorecard for risk as a way of capturing global attention and action. It is proposed as a way to "help measure the contribution of the public and private sectors and individual behaviors to health and well-being, to help identify opportunities to manage the causes of chronic diseases at the key levels of impact and to serve as a yard-stick of progress in delivering change" [2]. Similarly, the Institute of Medicine (IOM) convened a September 2009 workshop on "Promoting Health Literacy to Encourage Prevention and Wellness," in which the idea to develop a scorecard tool for disease prevention was articulated [12].

Applying scorecards for improved performance

Individual scorecards were originally used in business management and quality improvement programs. One major use of scorecards within management organizations comes in the form of the Balanced Scorecard (BSC). The BSC was founded by Robert Kaplan and David Norton of the Harvard Business School in 1992 in an attempt to create a "measurement for driving performance improvement" [13]. Their idea was based on the familiar assertion by "prominent British scientist, Lord Kelvin that 'if you cannot measure it, you cannot improve it'" [13]. The BSC incorporates various operational and financial metrics to create a "more robust measurement and management system" [13]. This model is now incorporated in various business and management quality control systems.

Scorecards are being incorporated into health care as well. The D5, for example, represents the 5 goals a person with diabetes needs to achieve to reduce risk of heart attack or stroke. This is an example of an all or nothing scorecard where all 5 points must be met to achieve the D5 score [14]. This simplified method of scoring was posited by Donald Berwick and Thomas Nolan in order to get better diabetes outcomes, in an attempt to "[raise] the bar and [illuminate] excellence in a social enterprise" [15]. Another important use of scorecards is for risk analysis and evaluation. In the Queen Elizabeth II Health Sciences Center (Halifax, Nova Scotia, Canada), a preoperative scorecard was developed to predict inhospital mortality from redo cardiac operations. By using previous mortality data, "a parsimonious logistic regression model was developed" [16], which was then used to create the scorecard. This clinical tool takes into account key risk factors like age, current procedure type, type and number of previous procedures, and renal failure. The total number score derived from these risk factors then correlates to the percent risk of mortality. This scorecard builds upon

TABLE 1. continued

ACC	HMS	Jiao et al. (2009), Mozaffarian et al. (2009)	Patterson et al. (2007), Cleary et al. (2006)
X	X <120/80 mm Hg		X
	X	X BMI <25	X
	X ≥150 min/ week	X	
X	X	X	X
X	X	X	
X Reduce LDL, Increase HDL	X <200 mg/dl		X Control LDL
	X Keep fasting blood sugar <100 mg/dl		X
		X	

mortality data to allow for a more exact assessment of procedure candidates in order to reduce mortality in high-risk patients [16].

Other more general health scorecards have been developed and are currently available free online. The American Heart Association and American Stroke Association developed *My Life Check*™, which incorporates *Life's Simple 7*™ *Action Plan*. This online scorecard asks users to register basic information and then guides them through 20 questions on biometrics, diet, and lifestyle choices [17]. It includes detailed questions on nutrition but does not include a component asking about alcohol use. Similarly, the World Health Professions Alliance (WHPA) drafted a *recto verso* "Health Improvement Card" that assesses 4 key biometric values (BMI, fasting blood sugar, cholesterol, and blood pressure) and 4 lifestyle choices (diet, tobacco use, alcohol use, and physical activity). While this paper-based tool does not yield a final score, it does utilize a "green, yellow, red" color scheme to indicate health factors that need to be addressed [18]. A simplified version of this tool is available for use online [19].

The development of the Digital Health Scorecard

As early as the year 2000, the concept of a scorecard for evaluating chronic disease and raising health literacy was developed and disseminated. In the 2000 National Library of Medicine/Medical Library Association Leiter Lecture, an idea was put forth for developing a simple, modern (21st century), digitized health record, comprising 6 or more factors necessary for health [20]. At that time, the proposed factors included blood pressure/heart rate, BMI, and cholesterol levels, as well as a number of behavioral and preventive measures. The concept was based on the idea that "reporting of numbers and health status could generate dialogue and health-seeking behavior and be integrated with technology" [20,21]. In 2009, there were proof-of-concept meetings with various organizations at which early paper drafts of the current Digital Health Scorecard were presented (then titled "Take Care—7 Steps for Better Health," and later "Know Your Numbers"). Meetings and conferences included the United Nations Economic and Social Council (ECOSOC) annual ministerial review in Beijing, the World Health Communication Associates (WHCA) Geneva roundtable on the Millennium Development Goals (MDGs), the IOM roundtable on Health Literacy, the Council of Foreign Relations, and, in 2010, the Oxford Health Alliance annual summit. An early draft of this scorecard was introduced as a health literacy tool in the IOM Workshop Summary "Promoting Health Literacy to Encourage Prevention and Wellness" [12]. The IOM-commissioned paper for this workshop on integrating health literacy into primary and secondary strategies envisioned this tool as "a simple (parsimonious), but big idea" to be "some sort of galvanizing index that captures health and wellness" and to "facilitate individual and system monitoring of health literacy" [7,22].

More recently, there were advancements in the development of a more rigorous proof-of-concept and a prototype for the scorecard. In 2011, collaboration between Johnson & Johnson (J&J) and graduate students at Carnegie Mellon University established a proof-of-concept thesis paper for the scorecard, *Design, Implementation and Go-To-Market Strategy for the Digital Health Scorecard: A Social Marketing Approach to Health Literacy* [23]. This was conducted through a course under the direction of Rema Padman, PhD, Professor of Management Science & Healthcare Informatics at the Heinz

School of Public Policy. The collaboration also yielded a directional proof-of-concept as to how a web-based tool might function. Based on the outcomes and feedback received through this work, J&J developed a more polished interface design and an iPad-based fully-functional prototype.

This initial prototype for the Digital Health Scorecard was preliminarily dubbed "ScoreMyHealth," and was presented for feedback in a number of forums in 2012. These included presentations and breakout sessions at TEDMED and the National Aeronautics and Space Administration Human Health and Performance Centre (NHHPC) workshop *mHealth: Smart Media and Health, Applications Benefiting Life in Space and on Earth*. One of the key gaps identified in the initial scorecard model was the differential impact of the selected risk factors on one's overall health. Further, it became apparent during these early trial sessions that the Digital Health Scorecard would need to account for the frequent occurrence that many users were unaware of their precise biometric values. Based on this feedback, significant improvements to the usability and validity of the scorecard as a wellness and risk prevention tool were made. These included developing and incorporating a weighting formula and the development of creative options for users who did not know specific values. These approaches were validated and improved upon through review meetings with epidemiology and health communication experts at the London School of Hygiene & Tropical Medicine and Columbia University's Mailman School of Public Health.

This current article reviews the rationale and methodologies used to develop the Digital Health Scorecard, a tool for addressing patient, personal, consumer, and global health needs. This includes an overview of how the limited set of health risk factors were selected, the development of a scoring algorithm and weighting system, and a review of initial user testing data. The aim of the Digital Health Scorecard is to provide a key measure, a "digital health score," which can help educate and motivate people and patients to take action on the behavioral and biometric factors that drive personal risk for developing chronic disease. In so doing, the Digital Health Scorecard also aims to help systems on all levels better face the daunting health and economic burden stemming from the rising prevalence of chronic disease in both developing and developed nations.

METHODOLOGY

Selecting risk factors

The scorecard asks 7 key questions about one's health based on evidence-based risk factors that contribute to NCDs, disability, and death. The risk factors selected are as follows.

- Overweight/obesity (BMI)
- Physical inactivity
- Tobacco use
- Harmful alcohol use
- Elevated blood pressure
- Elevated total cholesterol
- Elevated blood glucose

These 7 health risk factors were selected based on WHO and other data that indicate a correlation between these risks and NCD incidence, prevalence, associated disabilities, and death. The November 2012 WHO report, based on a formal meeting concerning the global monitoring framework for the prevention and control of NCDs, identified the above 7 factors as key behavioral and biological risk factors from a set of 25 possible indicators "to monitor trends and to assess progress made in the implementation of national strategies and plans on NCDs" [24]. Selecting these risk factors and assigning healthy ranges also drew on evidence and published recommendations from various health and research organizations (Table 1).

Formula, algorithm, and weighting

The overall health score is calculated on a scale of 0 to 100, with 100 being the optimal score. Although alternative scales were considered, the consensus from expert review groups suggested that the relative meaning of scores on a 0-100 scale is implicitly understood by the general public because that scale is commonly used. The application uses a simple formula and is driven substantially by 2 variables that are dependent on user input (Figure 1). This formula is based on a system of demerits in which the user starts with a perfect score and loses points (P) based on suboptimal biomarker levels and/or lifestyle behaviors. The P value for each of the 7 risk factors is dependent on the risk factor range (present, partially present, or not present) of the individual (Table 2). The second variable used in score determination is weighting (W). While P is assigned based on 1 of 3 static values for each factor, as indicated in Table 2, the potential W value changes among the 7 risk factors. The value of W determines the proportionate contribution of a given risk factor to the overall health score. Whereas the P variable is aligned to well-accepted risk factor ranges, the W variable represents an innovation and contributes to the novelty and validity of this algorithm.

The weighting system and P values were initially determined using data from the Global Burden of Disease Study 2004, published in a comparative risk analysis (CRA) in 2009 by the WHO [1] (Table 3). The W values are inserted into a modifiable system in the Digital Health Scorecard software that allows for updating of numbers based on new research and data. The most recent W values used (in a Brazilian version of the scorecard launched on World Health Day in April 2013) utilized new data from *The Global Burden of Disease Study* 2010, published in the *Lancet* in December, 2012 [25]. By using Global Burden Of Disease (GBD) study data (including now available country-specific data), there is a consistent CRA methodology for each update (and country customization) of the

$$100 - \left(\sum_{i=1}^{7} P_i W_i\right) = \text{H.S.}$$

Perfect Score — Points lost due to unhealthy lifestyle choices and suboptimal biometric results

P = *degree of presence of health factor*
W = *weighted risk of health factor to overall health*
H.S. = *Health Score*

FIGURE 1. Health score formula.

scorecard; i.e., the methodology used by Ezzati et al. in their CRA, which is a component of the GBD study [25,26].

As indicated in Table 3, the specific GBD data that was used for developing the weighting system was based on disability adjusted life years (DALYs), as this metric not only incorporates number of life years lost, but also the number of healthy-living years lost due to chronic diseases. For the initial scorecard launch, specific high-income country numbers were used from WHO region America A, which comprises primarily the United States and Canada. Because there is overlap in mortality, morbidity, and NCDs between given risk factors like tobacco use and high blood pressure, consideration was given for those risk factors comprising 50% of the weighting; using the specifications of Ezzati et al. [25,26]. Additional weighting considerations were also made for the bivalent nature of alcohol risk curves and the increased alcohol risk for women, consistent with the CRA methodology conducted by Rehm et al. [27] from the same GBD study 2004. Only relative risk of diseases was used in the formulation of the weighting algorithm.

Descriptive features and final computations

With the computational components in place, additional features for calculating the score and final design components were implemented. The questions and visuals selected to get input from individual users were developed utilizing published health literacy and cultural competency standards [6]. One key learning from early prototype reviews was the need to account for situations in which subjects do not know some or all of their biometric values. It was observed by the authors that although individuals often did not know precise values, there were multiple reasons why this occurred. In some cases it occurred because the individual had not had a recent primary care physician physical, including blood analysis. In other cases, such an exam had occurred but the individual did not have ready access to their biometric data and could not recall it; however, of this group, a significant number knew which risk factors their healthcare provider had warned them about and conversely those factors for which no concern was expressed. This being the case, the Digital Health Scorecard was adjusted to enable individuals to respond “I don’t know” and select the statement that best reflects them, as follows:

i. I’ve had a check-up in the past year (including blood work) and was not advised that I have [health risk factor].
ii. I’ve had a check-up in the past year (including blood work) and was advised that I have [health risk factor].
iii. I’ve not had a check-up in the past year.

The first statement is correlated to the same P value as “risk not present,” whereas the second and third statements correlate to “risk present.” In the case of the third statement, it was considered that not having had a check-up in the past year was as much a concern as actually having the risk factor because it indicates a lack of knowledge about (and perhaps a lack of interest in regular assessments of) one’s health.

Information about each of the 7 risk factors is collected on different screens. The Digital Health Scorecard app then uses the data to calculate a final health score using the previously described algorithm and its weighting system (Figure 2). As the figure illustrates, in reporting back the collected data, each health risk factor is placed into 1 of 3 color-coded categories: good (green), caution (yellow), and at risk (red). When individual score components are deemed “caution” or “at risk,” the app provides a hypertext link to additional information on how to improve upon

TABLE 2. Risk factor ranges

	Risk Present	Risk Partially Present	Risk Not Present
BMI	>30 or <18.5	25-30	18.5-24.9
Cholesterol	>240 mg/dl total	200-239 mg/dl total	<200 mg/dl total
Blood Glucose	>125 mg/dl	>99 mg/dl	<100 mg/dl
Blood Pressure	>139 systolic	120-139 systolic	≤119 systolic
Alcohol Consumption	>4 drinks/day (m) >3 drinks/day (f)	3 drinks (f) 3-4 drinks (m)	0-2 drinks
Smoking	Yes	X	No
Physical Activity	<30 minutes 3 times per week	30 minutes 3 times per week	≥30 minutes 5 times per week

BMI, body mass index.

TABLE 3. Ranking of selected risk factors: 10 leading risk factor causes of disability adjusted life years by income group (high-income countries)

Rank	Risk Factor	DALYs (millions)	Percentage of total
1	Tobacco use	13	10.7
2	Alcohol use	8	6.7
3	Overweight and obesity (high BMI)	8	6.5
4	High blood pressure	7	6.1
5	High blood glucose	6	4.9
6	Physical inactivity	5	4.1
7	High cholesterol	4	3.4
8	Illicit drugs	3	2.1
9	Occupational risks	2	1.5
10	Low fruit and vegetable intake	2	1.3

DALYs, disability adjusted life years; BMI, body mass index.
Table adapted from World Health Organization [1].

that health factor and one's overall health. For the purpose of the inaugural U.S.-based release, the hypertext links lead the user to www.healthfinder.gov and www.cdc.gov for these information resources. Additional options to customize links to reputable sources are envisioned (e.g., National Cancer Institute mHealth based Smoking Cessation Program).

Another key feature was incorporated as a result of prototype feedback. The authors observed that when users received their health scores, they often asked how their score would have varied had they answered the questions differently. To this end, the app was modified to offer a "what if" modeling capability. Upon receiving a health score, the individual can now select "what if" and see how the score changes when different answers are offered. For example, a user can model the impact of losing "XX" pounds (or "XX" kilos in the metric version), cutting back on alcohol consumption, or quitting smoking, etc.

DISCUSSION

Technology platforms

The Digital Health Scorecard application was introduced on the Windows 8 platform, in coordination with Microsoft, on October 23, 2012. Following this launch—taking advantage of early feedback—were versions for other major consumer technology platforms, including iOS, Android, and web browser. In all cases, there is no cost to users to download or utilize the app. The intent is to ensure that individuals have free access to the tool on their technology platform of choice; consumer preferences across these platforms will be carefully monitored. Though there may be populations that prefer traditional browser-based tools, it is believed that given the growing dominance of mobile technologies, consumers will ultimately prefer to access the app on phone and tablet platforms. As such, the largest investment of both resources and time has gone into these modalities. Mobile versions present obvious advantages, enabling users to input and access data wherever they may be: home, a doctor's office, a health fair, a pharmacy, or with friends and family. The app does not require a continuous data connection, so the absence of cellular data or Wi-Fi does not prevent use; however, if the user is connected, data such as the final health score with linkage to age, gender, and zip/postal code can be aggregated.

All versions of the Digital Health Scorecard, regardless of platform, can upload data from each session to a central Microsoft Azure cloud-based database (except when data connectivity is absent, as previously noted). At no time is any personally-identifiable information captured and stored; however, the aggregated data does include basic demographic identifiers including age, gender, and zip/postal code (mobile apps will provide additional GPS data). As

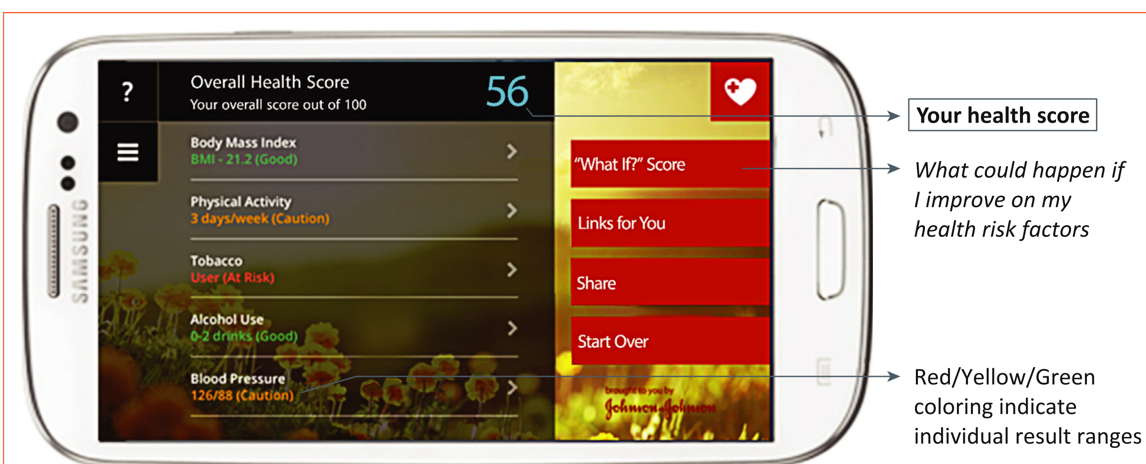

FIGURE 2. Scorecard app final results screen pictured on an Android phone.

such, basic reporting and analytic capabilities have been enabled for research purposes.

In designing the user experience, based on user feedback, minimization of the time required to receive a health score was considered paramount. Initial observation suggests that a user who knows her/his biometrics can receive a health score in as little as 3 minutes. Users who do not know their biometrics and therefore must navigate the secondary questions regarding prior conversations with healthcare providers (as described previously) may require about 5 minutes. Equally important in the design of the digital experience was the creation of a user interface that is visually comforting and technologically forward without impeding access or ease of use. Experts in user interface design were employed and leveraged extensive experience in the creation of mobile-friendly digital landscapes. The interface takes a user though the 7 required biometric and behavioral data elements, making extensive use of soothing, aspirational, and/or contextually-relevant background imagery, along with health literate terminology. The formally released versions of the Digital Health Scorecard app benefited greatly from feedback gained by prototype users at TEDMED and other events.

There are a number of platform-specific capabilities that have been implemented and that will be measured over time. The Windows 8 and web-browser based versions enable users to print a report that can be used to facilitate conversations with healthcare providers. For the mobile versions of the app, the developers implemented the ability to e-mail a similar report to a healthcare provider, friends/family, or even to oneself in order to be printed at a later time. These mobile versions also incorporate social media features, although actual scores are not shared through such services (specifically, Facebook and Twitter).

Mobile versions of the Digital Health Scorecard were built to take full advantage of touch technology. As such, most data inputs are made using visual touch controls, such as slider controls and selection buttons; even in the browser-based version. The entire app can be experienced without the need to type in data using on-screen keyboards, with one notable exception: the demographics collection screen requests users to type a postal code. This particular data element, however, is an optional field and can be skipped at the user's discretion. The Windows 8 and browser-based versions of the application serve as hybrids in that they run both on mobile tablets as well as on desktop/laptop computers. Given the growing demand for touchscreen computing even on nonmobile devices, the app was built to always favor touch, though it works equally well using a traditional mouse and keyboard equipped computer.

Studies suggest that disparities do exist with Internet and mobile phone usage [28]. These studies also suggest a shift in which platforms are used to access the Internet: users across demographic groups are eschewing the ownership of computers (desktop, laptop, etc.) and going directly to mobile phones [28]. The integration of the Digital Health Scorecard to mobile devices such as mobile phones and tablets could prove useful in increasing digital health access to distinct population groups.

Future considerations

We realize that this scorecard and the resulting health score will not be a perfect metric for NCD prevention. This is a relatively simple assessment of health risk when compared to the complexities of the human body. We recognize that there are important risk factors related to health and wellbeing that are not addressed by this application, such as family histories, diet, immunizations, preventive procedures, and emotional health and wellbeing, among others.

Furthermore, the GBD estimates used in preparing the weighting for the algorithm are based on CRA "clustered risk factors" analysis. As such, this data is acquired through meta-analysis of large population groups and is also subject to assumptions. There have been arguments against the correlation of such data to individual health as a predictor of risk. A cohort study could provide more exact data to be linked to the algorithm's weighting; however, such studies are limited by their highly specific nature and variance in methodology. The GBD estimates are available for multiple geographic regions (including low- and middle-income areas around the world) and ensure that the data for all risk factors are acquired and assessed using the same methodology. This, in turn, assures consistency for the assessment of all risk factors for users of the Digital Health Scorecard. Even so, the highly dynamic nature of the programming of this app allows for future changes as more appropriate and better quality studies come up.

The data that serve as the basis for the scorecard are based on peer-reviewed CRAs conducted by some of the world's best public health institutions united under the initiative of the GBD studies. One of the innovative aspects of the Digital Health Scorecard relates to "democratizing" this data and making it practically available for use by individuals in their daily lives. While the scorecard is limited to 7 key risk factors for health, we believe the factors chosen are most easily identifiable and measurable by users. The risk factors chosen were ranked by the WHO and others as among the highest for causes of NCD-related disability, mortality, and morbidity. In our attempts to create a simple and accurate 7-step tool, it was decided that measurements such as diet would be more complicated to recall and record and could contribute to discrepancies. As for mental and emotional health, there is no significant data at this time available from the GBD study source linking those risk factors to NCDs—chronic disease being the primary focus of this scorecard.

Although there is a focus on chronic disease, the scorecard is not intended to be a diagnostic tool or a predictor of specific diseases. Instead, it is intended to be a simple application, in the style of a checklist, that highlights health risk factors that could contribute to the development of NCDs. The scorecard provides just one number, thus establishing a metric for an individual's overall health risk from 7 key factors, which can enable them to better comprehend these risks. While the metric is the innovation for action, the app also provides explanations and linkages to evidence-based resources to improve one's score and improve health literacy. The "what if?" function allows for the user to interact with the medium, for mental modeling, to incite and support appropriate behavioral action. In this way, the scorecard can also be used as a health literacy tool that makes general users, consumers, and patients more aware of the important areas of their health that need to be focused on and addressed. We hypothesize that (and will track whether) Digital Health Scorecard use will prove to be an impetus for people to consult with their physicians on areas of concern, have more regular check-ups, and increase their use of community support services. Moreover, this metric, when aggregated, can also be used and interpreted on a variety of levels—from community to global—to identify critical problems in population health and galvanize multisectoral responses ranging from employer initiatives to government-sponsored educational and service provision focused on addressing identified population risks.

Since its launch through the Microsoft Windows 8 app store in October of 2012, the Digital Health Scorecard has been used more than 25,000 times. It is receiving favorable reviews on the Windows Store app page. This launch version of the scorecard has been presented at public events, including the mHealth 2012 summit in Washington, D.C., and the IOM health literacy meeting at the New York Academy of Medicine. Subsequently, versions for Apple iPhone/iPad and Google Android phones have been released into their respective app stores. The most recent versions have been integrated with social networking websites, Facebook and Twitter, allowing for more user connectivity and awareness.

SUMMARY

The potential reach and impact of this novel health literacy tool is significant. With planned technological and country-specific updates, more users will have the chance to access and complete and use the Digital Health Scorecard to enhance their personal NCD health literacy. They will also be able to share and compare their "digital health score" with family members, peers, and even their own physicians. Current plans call for presentations of the scorecard at numerous health-related conferences and events. Through these initiatives and with continuing language and data updates, we are hoping that the Digital Health Scorecard will reach many more users globally. A variety of research plans aim to see how the "digital health score" correlates with actual burden and how the scorecard can be used in different settings (e.g., workplace wellness programs, clinical trial recruitment, and community public health campaign planning).

While we believe this new metric can advance NCD prevention and care, it is not seen as a stand-alone entity. It does not replace the support and information provided by physicians and other health care providers. It needs to be well linked to other community-based information and evidence-based support services (e.g., smoking cessation hotlines, physical activities, and nutrition services).

While it does not cover all levels of a person's health and wellbeing, this application will allow people to assess the level of their risk for chronic disease and also track it over time. More importantly, it will highlight for individuals where they need to improve to reduce their risks and provide them with resources to achieve this goal. By providing just one number, users will be able to better visualize and judge their health-risk status. In addition to this, health professionals and policy makers, by aggregating results, will have a new source of data to assess and understand population health, as well as to identify key health areas that could be addressed to avert the dire consequences of the projected crippling health and financial consequences from NCDs.

ACKNOWLEDGMENTS

The authors thank Fikry Isaac, MD, at Johnson & Johnson, Dean Linda Fried, MD, MPH, at Columbia University Mailman School of Public Health, Rema Padman, PhD, at Carnegie Mellon University Heinz School of Public Policy, and Michael Hodin, PhD, at The Council on Foreign Relations.

Conflict of interest statement: Financial support for the Digital Health Scorecard and associated research was provided by Johnson & Johnson. Scott Ratzan was employed at Johnson & Johnson as Vice President of Global Health at the time that the research was conducted. Michael Weinberger is employed at Johnson & Johnson and serves as Director, Marketplace Innovation. Gary Kocharian is an intern at Johnson & Johnson, serving as a global health researcher. Franklin Apfel is the Managing Director at World Health Communications Associates, which contracted with Johnson & Johnson to provide scientific and implementation support.

REFERENCES

1. World Health Organization. Global health risks: mortality and burden of disease attributable to selected major risks. Geneva: World Health Organization; 2009.
2. Bloom DE, Cafiero ET, Jané-Llopis E, et al. The global economic burden of noncommunicable diseases. Geneva: World Economic Forum; 2011.
3. World Health Organization. United Nations high-level meeting on noncommunicable disease prevention and control. Political declaration of the high-level meeting of the General Assembly on the prevention and control of non-communicable diseases. Available at: http://www.

who.int/nmh/events/un_ncd_summit2011/en/. Accessed February 22, 2013.

4. World Health Organization. Development of an updated action plan for the global strategy for the prevention and control of noncommunicable diseases covering the period 2013 to 2020. Available at: http://www.who.int/nmh/events/2012/ncd_action_plan/en/index.html. Accessed February 22, 2013.
5. Siegel A, Etzkorn I. When simplicity is the solution. Wall Street Journal. March 29, 2013. http://online.wsj.com/article/SB10001424127887324000704578386652879032748.html?KEYWORDS=complexity. Accessed April 1, 2013.
6. Rudd RE, Anderson JE. The health literacy environment of hospitals and health centers—partners for action: making your healthcare facility literacy-friendly. National Center for the Study of Adult Learning and Literacy and Health and Adult Literacy and Learning Initiative, Harvard School of Public Health. Available at: http://www.ncsall.net/fileadmin/resources/teach/environ.pdf. Accessed May 10, 2013.
7. Ratzan SC, Parker R. Introduction: health literacy. In: Selden C, Zorn M, Ratzan SC, Parker R, editors. National Library of Medicine current bibliographies in medicine. 1st ed. Bethesda, MD: U.S. Dept of Health and Human Services, NIH, NLM Pub; 2000. v.
8. Gawande A. The Checklist Manifesto: How to get things right. New York: Metropolitan Books; 2010.
9. Pronovost P, Needham D, Berenholtz S, et al. An intervention to decrease catheter-related bloodstream infections in the ICU. N Engl J Med 2006;355:2725–32.
10. World Health Organization. Safe surgery saves lives: the second global patient safety challenge, surgical safety checklist. Available at: http://www.who.int/patientsafety/safesurgery/en/. Accessed February 22, 2013.
11. Spector JM, Agrawal P, Kodkany B, et al. Improving quality of care for maternal and newborn health: prospective pilot study of the who safe childbirth checklist program. PLoS One 2012;7:e35151.
12. Ratzan SC. Integrating health literacy into primary and secondary prevention strategies. Presented at: Institute of Medicine Workshop on Integrating Health Literacy into Primary and Secondary Prevention Strategies; September 15, 2009; Washington, DC.
13. Kaplan RS. Conceptual foundations of balanced scorecard. Working Paper, 10-074. 2010. Available at: http://www.hbs.edu/faculty/Publication%20Files/10-074.pdf. Accessed May 10, 2013.
14. MN Community Measurement. The D5: five goals for living well with diabetes. Available at: http://mnhealthscores.org/thed5/. Accessed April 12, 2013.
15. Nolan T, Berwick D. All-or-none measurement raises the bar on performance. J Am Med Assoc 2006;295:1168–70.
16. Launcelott S, Ouzounian M, Buth KJ, Légaré JF. Predicting in-hospital mortality after redo cardiac operations: development of a preoperative scorecard. Ann Thorac Surg 2012;94:778–84.
17. American Heart Association, American Stroke Association. My life check. Life's simple 7. Available at: http://mylifecheck.heart.org/Default.aspx?NavID=1&CultureCode=en-us. Accessed February 22, 2013.
18. World Health Professionals Alliance. NCD campaign: WHPA health improvement card. Available at: http://www.whpa.org/ncd_campaign_health_improvement_card.htm. Accessed February 22, 2013.
19. World Health Professionals Alliance. Noncommunicable disease campaign: test the card. Available at: http://www.whpa-ncdcampaign.org/. Accessed February 22, 2013.
20. Ratzan SC. Quality communication: the path to ideal health. Presented at: NLM/MLA Joseph Leiter Lecture; 2000; Bethesda, MD.
21. Miron-Shatz T, Ratzan SC. The potential of an online and mobile health scorecard for preventing chronic disease. J Health Commun 2011;16:175–90.
22. Ratzan SC. Appendix C: integrating health literacy into primary and secondary prevention strategies. In: Promoting Health Literacy to Encourage Prevention and Wellness: Workshop Summary. Washington, DC: The National Academies Press; 2011. p. 84.
23. Bhavnani A, Tyrrell R, Allen E, et al. Design, Implementation and Go-To-Market Strategy for the Digital Health Scorecard: A Social Marketing Approach to Health Literacy [master's thesis]. Pittsburgh, PA: Heinz College, Carnegie Mellon University; 2011.
24. World Health Organization. Revised WHO Discussion Paper on the development of a comprehensive global monitoring framework, including indicators, and a set of voluntary global targets for the prevention and control of NCDs. Geneva: World Health Organization; 2012. 2.
25. Lim SS, Lopez AD, Murray CJL, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet 2013;380:2224–60.
26. Ezzati M, Van der Hoorn S, Rodgers A, Lopez AD, Mathers CD, Murray CJL. Potential health gains from reducing multiple risk factors. In: Ezzati M, Lopez AD, Rodgers A, Murray CJL, editors. Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors. vol. 2. Geneva: World Health Organization; 2004. p. 2167–91.
27. Rehm J, Room R, Monteiro M, et al. Alcohol use. In: Ezzati M, Lopez AD, Rodgers A, Murray CJL, editors. Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors. vol. 1. Geneva: World Health Organization; 2004. p. 959–1109.
28. Pew Internet & American Life Project. Summary of findings: mobile access 2010. Available at: http://www.pewinternet.org/reports/2010/mobile-access-2010.aspx. Accessed April 17, 2013.