Use of Financial Hardship as a Metric for Assessing Financial Toxicity in Surgical Trauma Patients

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Background: Financial toxicity is the detrimental impact of health care costs that must be mitigated to achieve universal health coverage. Catastrophic health expenditure (CHE) is widely used to measure financial toxicity but does not capture patient perspectives of unaffordable health care costs. Financial hardship (FH), a patient-reported outcome measure, is currently underutilized but may be an important adjunct metric. The authors compare CHE to FH as metrics evaluating financial toxicity.

Methods: A prospective, multicenter cohort study was conducted across 3 public and private tertiary-care hospitals in India. Adult surgical trauma inpatients in plastic and orthopedic surgery departments were assessed. The development of CHE, health expenditures $>10\%$ of annual income, and FH, the patient-reported impact of financial toxicity in the form of asset liquidation, debt acquisition, and job loss, were compared by the health system and using logistic regression models.

Results: Among 744 surgical trauma patients, low income, longer hospital stays, and increased injury severity were significantly associated with the likelihood of incurring CHE and FH ($P<0.05$). Only FH was significantly associated with lack of insurance (OR: 0.22; 95% CI: 1.14–2.71). Public hospitals had higher rates of FH than CHE (55% versus 23%). Private hospitals had more CHE than FH (53% versus 32%).

Conclusions: FH is an important metric of financial toxicity that provides important adjunct information to CHE for at-risk populations. FH is particularly informative for public institutions with low direct medical costs. Nuanced utilization of CHE and FH provides a more comprehensive, patient-oriented approach to evaluating unaffordable health care costs that can help shape financial risk protection policy.

Key Words: Financial toxicity, surgical trauma, policy

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Each year more than 150 million people experience financial toxicity while receiving medical care.[1] Financial toxicity is defined as the detrimental consequences of health care costs.[2] The most commonly used metric of financial toxicity is catastrophic health expenditure (CHE).[3–5] CHE is a binary, categorical variable calculated by comparing total health care costs to annual individual or household income. Although the threshold can vary, CHE is often characterized as health expenditures totaling over 10% of annual income.[6] Within the last decade, there has been a renewed call for universal health coverage and financial risk protection assurance for patients. The United Nations (UN) and World Bank recommend using CHE to measure financial toxicity and educate health financing policy as stated in the UN SDG (Sustainable Development Goal) 3 target 3.8.2 and the World Development Indicators.[7–10] The use of CHE as a primary metric for assessing financial toxicity among surgical patients has been further reinforced by the Lancet Commission on Global Surgery.[11] Despite the adoption of CHE as an official SDG metric, there has been limited progress in identifying and addressing health care costs using CHE.

Although CHE is an important objective metric, it has major limitations. First, measuring CHE is impractical, given the need for comprehensive hospital and patient-specific cost data in inpatient and ambulatory settings.[12] It is also difficult to capture granular data on savings, nonmonetary assets, loans, or other sources of debt.[13] Many low- and middle-income country pa-

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tients rely on informal channels, such as extended family, to facilitate the transient period of monetary difficulty, thus distorting outcomes of income and expense calculations.[14] Second, methods of income measurement and thresholds for CHE determination are variable.[12,13] In addition, CHE may under-estimate or over-estimate economic challenges faced by individuals and households, given the singular focus on medical costs in proportion to income. For example, in public health systems, CHE may be low in the context of subsidized direct medical costs, but patients may still report financial challenges in affording basic necessities despite not meeting the 10% threshold comparing health care costs and income. Therefore, measurement of CHE faces considerable implementation difficulties and falls short in comprehensively evaluating diverse patient populations needs.

Patient-reported outcomes are another approach to consider when evaluating financial toxicity and unaffordability of health care costs. Financial hardship (FH) is an example of a patient-reported outcome measure that evaluates the downstream impact of unaffordable health care costs as reported by the patient directly.[3,15] It assesses the impact of financial toxicity at the individual patient level in the form of asset liquidation, debt acquisition, and job loss.[16] FH has not been broadly adopted due to the absence of a comparable method and standardized measure for its widespread application. However, in the context of health care delivery, patient-reported outcomes have the unique potential to capture detailed, noncategorical accounts of the challenges patients experience, measure financial toxicity through a lens relevant to patients' everyday lives, and identify context-specific solutions through robust scientific data collection methods.

The goal of this study is to compare CHE to FH as metrics that evaluate financial toxicity among surgical patients. We compare preinjury predictors and measure site-specific variability in the rates of CHE versus FH, using CHE as the current "gold standard" for financial toxicity. We hypothesize that FH will be a more implementable, practical metric than CHE, given its emphasis on patient-reported outcomes, ease of data collection, and ability to highlight potential solutions. Identifying the optimal metric of financial toxicity is important to educate clinicians, health systems, and policy advocates on the most effective and feasible way to evaluate financial outcomes.[17] Lack of a generalizable, reproducible measurement method to collect financial data in patients has limited our ability to track short-term and long-term outcomes and implement solutions relevant to patients struggling with unaffordable out-of-pocket costs. Understanding the advantages and limitations of CHE and FH using individual patient data rather than modelled analyses could help educate the process of standardizing how we collect financial data from patients in a more feasible manner than the current state.

METHODOLOGY

Study Design and Participants

A prospective, multicenter, longitudinal cohort study was conducted to evaluate CHE and FH in patients undergoing plastic and orthopedic surgery after trauma in tertiary care public and private hospitals in India. The public hospital model was government-funded, with free direct medical costs for patients. The private hospitals employed a fee-for-service model. Two different private hospitals were selected to account for variations in private-sector payment models. The public hospital represents the top government health care institution in the country and was selected given its reputation as the national gold standard to control for confounding related to clinical management strategies and resources. This study was approved by the Institutional Review Board and Ethics Committees of Harvard Medical School, Ganga Hospital, All India Institute for Medical Science, and Saveetha Medical College Hospital. Informed consent was obtained from all patients.

Individuals over 18 years of age undergoing inpatient operative intervention after trauma in the plastic or orthopedic surgery departments between October 2021 and January 2023 were eligible for inclusion. All eligible patients who consented were included. Data were collected on admission to reflect preinjury socioeconomic status and demographic factors. Clinical outcomes and financial data were evaluated on discharge. Financial data included direct medical costs (eg, hospitalizations, pharmaceutical bills, laboratory charges–related expenses), direct nonmedical costs (eg, cost of transportation, food, lodging), and income. CHE was calculated using this data. Financial hardship was assessed by evaluating patient-reported outcomes regarding the need to borrow money, sell land or possessions, take children out of school or job loss, or receive donations to afford care. All data were obtained by trained investigators through a combination of detailed electronic medical records and direct patient reports. Survey instruments are attached as Appendix A (Appendix, Supplemental Digital Content 1, http://links.lww.com/SCS/G909).

Measurement of Financial Toxicity at Discharge

CHE was measured by assessing the sum of direct medical costs and direct nonmedical costs as a ratio of annual household income. If this exceeded 10%, the patient was classified as having CHE. The following formula was used:

$$\frac{(\text{Direct Medical Costs}) + (\text{Direct Non-medical Costs})}{\text{Annual Household Income}} \geq 0.1$$

FH was measured by assessing whether patients needed to borrow money, sell assets, remove a child from school, rely on donations, or lost their jobs due to the health care encounter. If one or more responses were affirmative the patient was classified as having FH. The tool for FH assessment was developed using pre-existing literature and previously utilized in various settings.

Statistical Analysis

We used complete-case analysis and excluded any missing data points.

We analyzed the study population's characteristics, including demographics, income, and clinical outcomes, as absolute numbers with concomitant percentages. We prespecified 6 baseline covariates—age, sex, total household income, insurance status, hospital length of stay, and injury severity score at admission—that may be determinants of financial toxicity based on a priori background knowledge. Initially, we conducted univariate analyses using logistic regression to assess the association between these factors and CHE. Subsequently, we performed multivariate adjustment, including all 6 covariates. We then repeated the univariate and multivariate analyses using FH as the outcome. To determine whether FH offers independent information on financial toxicity compared with CHE, under the assumption that CHE is the current gold standard metric of financial toxicity, we conducted an additional multivariate analysis further adjusting for CHE.

We evaluated whether the prevalence of CHE and FH demonstrated site-specific variation between public and private health systems using absolute numbers and χ^2 tests. All the analyses were performed using R (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

A total of 744 patients were included. Demographic and clinical characteristics of the study population at the time of hospitalization are in Supplemental Table 1 (Supplemental Digital Content 2, http://links.lww.com/SCS/G910).

Characteristics Associated With Likelihood of Catastrophic Expenditure and Financial Hardship

Univariate Analyses

In the univariate analyses, patients with CHE upon discharge were more likely to be male (OR: 1.75; 95% CI: 1.19–2.56), have low income (OR: 6.67; 95% CI: 4.55–10.00), have an extended length of hospital stay (OR: 2.15; 95% CI: 1.35–3.43), and a moderate injury severity score between 25 and 49 (OR: 1.64; 95% CI: 1.14–2.35). Our analysis revealed that, sans gender, all the covariates associated with CHE were also associated with FH, with insurance status as an additional characteristic associated with FH alone. Patients with FH upon discharge were more likely to be uninsured (OR: 3.22; 95% CI: 2.17–5.26) (Supplemental Table 2, Supplemental Digital Content 2, http://links.lww.com/SCS/G910).

Multivariate Analyses

Multivariate analyses demonstrated similar patterns. Patients incurring CHE and FH were both less likely to have high total household income. For household income in the highest tertile, the odds of CHE were 0.15 (95% CI: 0.09–0.22), and FH was 0.31 (95% CI: 0.19–0.5). Patients with FH were significantly less likely to have insurance (OR: 0.22; 95% CI: 0.12–0.4). These patients were significantly more likely to have a moderate injury severity score between 25 and 49 (OR: 1.76; 95% CI: 1.14–2.71). CHE was not significantly associated with insurance status (OR: 0.75; 95% CI: 0.46–1.22) or a moderate injury severity score between 25 and 49 (OR: 1.16; 95% CI: 0.74–0.82). CHE and FH were not significantly associated with age (Supplemental Table 2, Supplemental Digital Content 2, http://links.lww.com/SCS/G910).

Multivariate Analyses Adjusted for CHE

We observed similar results when the associations between these covariates and FH were specifically examined after adjusting for CHE—indicating that the predictive power of these covariates for FH remained consistent even when controlling for the presence of CHE, and FH is similar in demonstrating financial toxicity. In our adjusted analysis, patients were more likely to have a moderate injury severity score between 25 and 49 (OR: 1.76; 95% CI: 1.14–2.72), the longer length of stay (OR: 5.17; 95% CI: 2.66–10.05), absence of insurance (OR: 4.55; 95% CI: 2.5–8.33) and lower income (OR: 3.33; 95% CI: 2.00–5.56) (Supplemental Table 2, Supplemental Digital Content 2, http://links.lww.com/SCS/G910).

Health-system Dependent Development of Catastrophic Expenditure and Financial Hardship

Clear site-specific differences were visible in the development of either CHE or FH, with the 2 hospital systems demonstrating opposite trends. Overall, 46% (n = 342) of patients experienced CHE and 37% (n = 277) experienced FH, of these 20% (n = 146) experienced both CHE and FH. In the public hospital system, 55% (n = 98) reported FH, while only 23% (n = 42) reported CHE. More than one-third of the patients (36%, n = 65) experienced FH without CHE. Conversely, considerably more patients incurred CHE (53%, n = 300) than FH (32%, n = 181) in the private hospital models, and 33% (n = 187) experienced CHE with no FH. The differences in CHE and FH overall and per health system were statistically significant ($P \leq 0.005$) (Supplemental Table 3, Supplemental Digital Content 2, http://links.lww.com/SCS/G910).

DISCUSSION

Accurate and feasible measurement of financial toxicity is critical to define the impact that health care-associated costs have on patients and households. In this study, FH was at least equivalent to CHE in detecting financial toxicity based on the significant relationships with sociodemographic and clinical variables, particularly insurance, and predominance in public hospitals. Importantly, however, nuanced interpretations and usage of CHE and FH are imperative, given variable rates of CHE and FH in private and public hospital settings.

The widespread usage of CHE as a "gold standard" metric for financial toxicity, particularly in modelled studies, is unsurprising given the ability to formulate broad-based, country-level comparisons.[9,18] Relative ease of CHE calculation using general, national estimates of household expenditure and income data offers practical benefits for creating generalizable financial risk protection guidelines.[19] However, lack of universal agreement on measurement methods and thresholds, as well as the absence of linkage to contextual factors are methodological challenges that undermine generalizability of CHE as a metric.[20] In addition, in our experience, the detailed calculations and data points necessary to calculate CHE are not feasible for adoption into routine clinical practice and extremely challenging for high-volume hospitals without designated staff solely dedicated to data collection.[5] The resource and time-intensive nature of evaluating CHE is one clear reason why CHE measurement has not been widely implemented outside the context of research. Moreover, our findings suggest that there are patients who report financial toxicity in the absence of calculated CHE, indicating the importance of measuring adjunct patient-level, individual data. Therefore, we believe that FH is an important adjunct to CHE in measuring financial toxicity in the form of patient-reported outcomes.

Patient-reported outcome measures (PROMs) have gained attention as new tools to understand outcomes following health care interventions and drive health care improvements.[21–23] In 2009, Porter[24] advocated for using PROMs as a metric within value-based health care frameworks. FH acts as a PROM for understanding financial toxicity as it provides information regarding the degree of economic impact, coping strategies, and requisite support from the patient's perspective after receiving treatment. It recognizes that out-of-pocket costs are not the sole drivers of financial toxicity, and other factors like health system financing strategies, job loss, family support, and other assets play a major role and must be adequately captured.[17,25] There are important benefits to consider. First, FH provides granular data at the individual patient level regarding manifestations of financial challenges in the form of the effect on patients' lives. Because of this, it could be used to design targeted interventions, such as community-based microfinancing endeavors or employment-based insurance, to mitigate financial toxicity. Second, the measurement of FH fits easily into clinical contexts as it can be incorporated into admission history and discharge counseling. Accurate measurement of FH, unlike CHE, does not require detailed documentation of expenditures, income, and hospital costs before, during, and after hospitalization. This ease of application of FH better allows for routine use worldwide. Finally, FH can enable the identification and implementation of patient-centered solutions designed to help patients cope with health care expenses. As such, FH can sig-

nificantly enhance our understanding of surgery-associated financial toxicity and inform the development of effective policy interventions that prioritize the needs of patients on the ground.

There are important considerations when deciding which metric individual institutes should use. While measuring CHE and FH provides the most comprehensive outlook on financial toxicity, this data can be logistically challenging and expensive to collect. Therefore, we suggest institutes with lower direct medical costs (ie, government, public, or charity hospitals with subsidized care) should consider prioritizing FH, while those with high direct medical costs may note the greater relevance of CHE. Lastly, when designing interventions against financial toxicity, the metric of choice should be determined by the intervention target. For example, CHE may be a more sensitive indicator of intervention success for reducing direct medical costs. Conversely, if the goal is to address the impact of medical debt on job security, FH is more relevant.

There are important limitations to consider. First, this study was conducted in tertiary care centers using robust, intensive data collection procedures. Collecting this data in other environments may be more challenging, given the extent of expertise required by on-ground study teams. We cannot rule out that the differences observed between CHE and FH in our data set may be partially attributable to variations in the health systems. High-quality, high-volume tertiary care centers offering similar levels of expertise and assessing patients from all sociodemographic backgrounds were deliberately chosen to minimize such possible influence. Second, this study cohort was comprised of surgical trauma patients in plastic and orthopedic surgery departments. Importantly, however, trauma patients represent a broad, generalizable sample of patients from diverse socioeconomic backgrounds and clinical conditions, and findings relate to other surgical and emergency care. Lastly, the data captured for CHE and FH was self-reported and, thus, susceptible to recall and reporting biases. To diminish this, we surveyed the patients immediately upon hospitalization and at multiple points during hospitalization. The same research personnel followed up with their respective patients within the hospital to better verify all conflicting information. Despite these limitations, our study provides valuable insights into the best ways to measure the financial burden of health care using CHE and FH.

CONCLUSIONS

Relying solely on CHE as a panacea for measuring financial toxicity among surgical patients may result in a distorted perspective and insufficient strategies to combat it universally. Establishing the utility of FH as an accurate measure establishes the value of patient-reported outcomes in this field, improves the feasibility of data collection, and educates future intervention development to mitigate the detrimental impact of surgery-induced financial toxicity.

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