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Editorial

Burden, need, or backlog: A call for improved metrics for the global burden of surgical disease

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A B S T R A C T

The global burden of disease (GBD) has been measured primarily through the use of the DALY metric. Using this approach, preliminary estimates were that 11% of the GBD is surgical. However, prior work has questioned specific aspects of the GBD methodology as well as its practicality. This paper refines other conceptual approaches based on met and unmet population need for services by considering incident and prevalent need as well as backlogs for treatment that can inform effective coverage of services. Some of these methods are tested using the example of surgical repair of cleft lip and palate. Measurement of disability incurred by delays in care may also be estimated through these approaches and has not previously been estimated through a validated model. These concepts may provide more practical information for individuals and organizations to advocate for scaling up surgical programs. While many surgical conditions are unique, as a single intervention can lead to cure, these concepts may also prove useful for non-surgical diseases. Further exploration of these approaches is merited in resource-limited settings.

1. Introduction: problems with the current burden of disease model

The burden of disease (BoD) framework was developed as a population measure of ill-health [1]. The disability-adjusted life-year (DALY) was a unique innovation because it added disability to mortality in a single metric, and since its inception, has been the primary BoD metric. One of its greatest benefits has been its facilitation of comparisons across disease categories and risk factors, and disparities across regions, enabled by the use a single uniform metric.

Nonetheless, in isolation, the DALY has little meaning to most audiences, and philosophical and methodological criticisms, such as the approach to disability-weighting, have been raised [2]. The most recent BoD study has attempted to address some of these concerns. Other models of disability advocate a social approach over a medical disease-based approach, highlighting social causes and interventions to improve well-being for persons with disabilities [3]. The Katz activities of daily life index and the Washington disability index, for example, provide practical measurement tools of disability burden, while many authors have also called for a novel internationally comparable disability measure.

Surgical conditions cut across all major disease categories (infectious, non communicable, injuries). This, among other reasons, has made it difficult to estimate surgical burden using the DALY approach compared to more "vertical" disease clusters. Surgical conditions are also unique because unlike many "medical" interventions, the treatment is often curative with a single intervention. Surgical planners are interested in measuring not only the surgical burden, but also the population impact of scaling up surgical interventions. Several studies have attempted to estimate burden averted by surgical wards in rural hospitals, but there remains a need for improved metrics [4].

2. Suggestions for change

Several proposals would address the needs highlighted above.

2.1. Use "need" rather than "burden"

Although the terms "burden of surgical disease" and "surgical need" have been used interchangeably, they are not identical. While BoD refers to "what is there", *need* implies "what is missing". BoD was primarily intended to aggregate health state data and was not designed for subdivision beyond the level of diseases and associated risk factors. *Need*, on the other side, has already been adapted for global surgery by dividing it into met, unmet, and unmeetable need [5].

We therefore propose the term "need" to quantify surgical disease and the impact of surgical care. This parallel pathway could allow further development of metrics appropriate to global surgery, without applying concepts of BoD in ways that they were not intended.

2.2. Disaggregate BoD into met/unmet, incident and prevalent

The concept of dividing surgical need into met, unmet, and unmeetable need suggested by Bickler et al. has proven extremely useful for global surgery. For any given country, region, or surgical condition, one can theoretically estimate a *total* need (in DALYs) for

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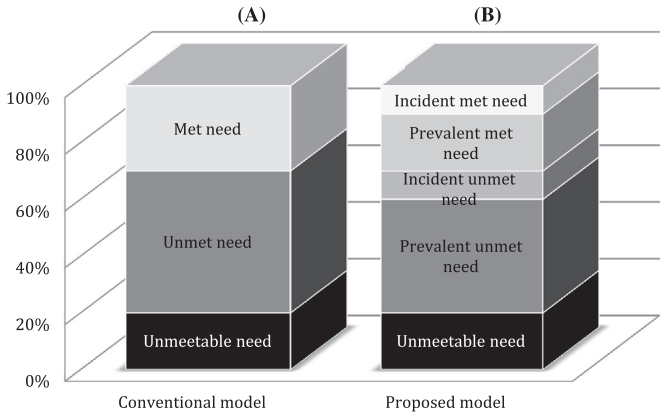

Fig. 1. The conventional (A) and proposed (B) models for components of burden of disease.

surgical care, a need met at any given point in time (in "averted DALYs") through current surgical activity, and an unmet need (in "avertable DALYs"). This is the essence of the "conventional model" depicted in Fig. 1A.

Furthermore, access to surgical care in LMICs is frequently delayed. For fatal conditions this results in increased mortality, but for non-fatal conditions, the significant BoD caused by this delay has not been measured to date. Thus when surgical care is provided to a population, the *met* need will be partly "timely met" (or "incident met", for new cases that are successfully treated on time), and "delayed met" (or "prevalent met", for cases that are being treated in a delayed time frame). Delayed provision of care results in an actual averted burden (calculated in future DALYs averted), but also finalizes a "lost" unmeetable need (calculated in DALYs lost before the intervention). Similarly, in any given population the unmet surgical need will include not only the new cases emerging during a period of time (the "new/incident unmet need"), but also those who have missed being performed earlier due to ineffective coverage (the "delayed/prevalent unmet need") (Fig. 1B). Appendix 1 provides a real-life example, using cleft lip and palate, and comparing metrics generated through the DALY approach with those generated through alternative metrics proposed here.

It is noteworthy that traditional summary DALY estimates include neither the backlog factor nor the lost unmeetable need. Fig. 2 depicts a hypothetical typical disaggregation of surgical need in ideal settings, in high-income countries (HICs), and in our LMIC calculation above. Besides truly unmeetable needs, only in the ideal setting is 100% of the need met promptly, at the "incident" stage. In the "real world" there will always be some delayed access resulting in needs met at the "prevalent" stage, as well as some unmet and unmeetable needs.

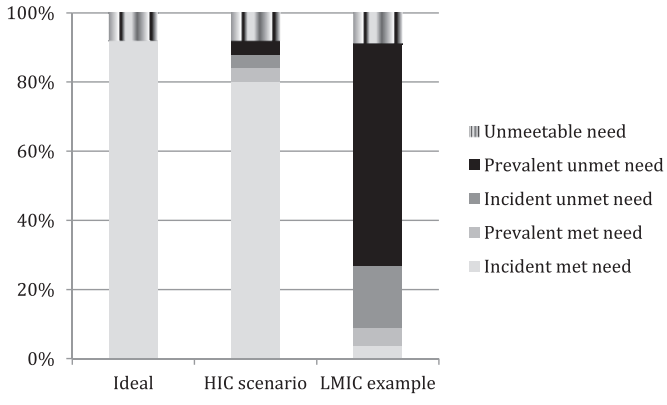

Fig. 2. Model disaggregation of surgical need in an ideal setting, in a high-income countries (HIC) scenario, and in the current calculation for low-and-middle-income countries (LMIC).

Furthermore, the disability associated with untreated surgical disease can increase over time, and render delayed surgical intervention less effective. This reality continuously inflates the unmet need at the expense of the met need. As a result, care can be delayed to the point of becoming so difficult to provide that it becomes ineffective, futile, or even undesirable (hence "realistically unmeetable"). Examples of such futility of intervention include unrepaired cleft palate beyond childhood, late-presenting tumors, and delayed presentation of gross hydrocephalus.

2.3. Start using backlog as key metric

The concept of "backlog"—i.e. the number of individuals waiting for a specific intervention—for primarily non-fatal conditions, is a clear measure of *unmet* surgical need. This has been difficult to estimate in LMICs with any accuracy—estimates exist only for a few selected surgical conditions (Table 1)—but not for dozens of other chronic and debilitating conditions [6–10].

In the absence of national or regional wait lists, the only option for backlog estimates would be extensive (and expensive) community surveys. For example, a recent survey in Sierra Leone showed that 25% of household members reported a surgical condition needing attention, while in Rwanda, a 41% lifetime prevalence of an operative condition was estimated using the same instrument [11,12]. Piloting the use of such metrics may require prioritized measurement of a few surgical conditions for validation, as proposed recently [13].

There is however another surrogate measure of backlog: the mean age delay between time of onset of a surgical condition and the time of corrective surgery. At a population level, each year of delayed intervention results in a new cohort of untreated patients, equal (assuming again no condition-related mortality) to the number of new cases with that condition appearing in the population. Thus a mean delay of 5 years in an intervention would generate 5 cohorts of untreated patients, as exemplified in the calculation above. In the case of congenital conditions, the cohorts equal the incidence of the condition in any given population, and the delay is the difference between the age at intervention and the ideal age of treatment. Any condition-related mortality would naturally decrease the size of successive cohorts. Fig. 3 adds change in backlog to a plot of the sample cleft palate calculation over a 10-year period.

As expected from the above assertions, provision of care in a population in excess of the yearly incidence of new cases would gradually result in a decrease in the mean age at treatment, reflecting a decrease in backlog [9,14,15]. Once the backlog for a specific condition is cleared in any given region, the unmet need becomes

Table 1
Estimated global surgical backlog for selected non-fatal conditions, compared to HIV care.

Cataracts	50 million eyes
Trichiasis	8.2 million people
Obstetric fistula	2 million women
Cleft lip/palate	1.1 million people
HIV care	*9 million people*

Tabin et al. [6–8], Poenaru [9], UNAIDS [10].