

Minding Your P's & R's

MORBIDITY AND DISABILITY

Michael W. Kita, MD

The reader will observe that our customary "P's and Q's" column has been changed to a "P's and R's" commentary this time, in keeping with the general theme of disability in this issue. When mortality is being studied, survival (P) and death rate (Q) are among the measures commanding attention. When morbidity is being assessed, P becomes event-free survival, the inverse of some event-rate R for morbid events of particular outcome-interest. Some of the unique methodologic issues which arise in morbidity measurement have been addressed in an earlier *Journal* article¹ and examples of morbidity abstracts occur regularly now in these pages.

Morbidity measurement by the life table approach possesses all the methodologic challenges that mortality measurement has, plus some that are qualitatively more difficult and others that are unique to morbidity study. Deaths — the endpoints in mortality studies — are relatively easy to define and count, even when cause-specific mortality is needed and requires some more precise definitions. Morbid events, by comparison, require careful and sometimes complex criteria-specification in order to assure that all counted events are the same or sufficiently similar, and in order to assure comparability and reproducibility of results when comparing to other morbidity studies.

Moreover, whereas death is a single irreversible endpoint, morbid events can be experienced recurrently and with varying degrees of severity, considerations which need to be formally addressed in specifying inclusion or exclusion criteria. Additionally, while censored lives in a mortality study include those withdrawn alive, dropped out, or lost to follow-up, censored lives in a morbidity study include the additional category of those who die during the study. In a morbidity study, death is a form of withdrawal. Dr. Singer's morbidity abstract in this issue of the *Journal* illustrates this last point, and also shows the ingenuity sometimes required to accomplish this (Dr. Singer used the Kaplan-Meier mortality data available in one of the figures in his source article to deduce the deaths, d , to include in his withdrawals, w).²

"Expected rates" — the basis for comparative morbidity and mortality conclusions — while not always easy to

V.P. & Chief Medical Director, UNUM Life Insurance Company of America, Portland, Maine.

obtain for mortality studies, are harder to come by for morbidity studies. Excess event rates (EER's) may use primary population incidence rates to yield r' for the event in question, or may estimate the r' to be so vanishingly small as to be effectively zero (i.e., $EER = r$). Since zero (0) is not mathematically meaningful for r' in the denominator of the Morbidity Ratio, the MR's in such cases are often simply given as "astronomical," or some small nonzero number (e.g. 0.1 or 0.01) is arbitrarily used.

Morbidity data can be reported in the clinical literature in a variety of forms — relative risk (RR) and standardized incidence ratios (SIR), which are often equivalent to morbidity ratios, the former as a decimal and the latter as a percentage; cumulative event-free survival rates, which are equivalent to $1 - R$; and extra or excess events, equivalent to either $(n - n')$, $(r - r')$, or EER, depending on how the number is arrived at. Data in these various forms can often be transformed into life tables (event tables) for either interval, aggregate or geometric data representation. *Table 1* summarizes some of the useful data relationships.

Once morbidity data has been calculated and tabulated, there still remains the challenge of relating excess event rates (expressed differentially as EER or proportionately as MR) to various rates of health care utilization, disability incidence, or other outcome measures of importance to clinicians, insurers, and policy formulators. In other words, they serve as an intermediate or indirect measure (index) of some greater phenomenon of interest. (see *Figure 1*) Recovery rates — from disability or from specified morbidity states — can also be modeled by statistical and actuarial means.

Disability itself is not a term with a single unambiguous or universal meaning, but rather something which has multiple definitions or distinct nuances of meaning depending on the particular context of its usage. Some definitions reflect the unique social, political, or legal environment of the country of origin.^{3,4} Others reflect cultural or historical differences in the evolution of disability concepts and products, resulting in disparities in terminology even within a single country. The following is a general taste of the "terminological soup" as it exists in the United States. Given the complexity of

the subject, the description is intended to be general and representative, and not exhaustive.

Disability protection can be provided through individual and group coverages, which are non-cancelable or renewable, or through riders such as Waiver of Premium riders. They are provided for various markets domestically and abroad. They exist as government or social programs (Social Security Disability, Workers' Compensation arrangements, etc.) and as private insurance offerings. Private insurers may participate in the disability market directly or via private label or reinsurance arrangements. Entitlement to certain benefits or services may be a right of citizenship (part of a national or social insurance scheme) or eligibility may be restricted to certain employment or impairment categories by legislation or product design. Benefits may extend for the short term (e.g. up to six months), intermediate (2-year or 5-year benefit periods), or long term (to age 65 or lifetime). Benefits can integrate in various ways, sometimes with overlap (additively) or sometimes by offsetting each other. Disability benefits can be viewed as salary continuation, income replacement, or asset protection, or in some instances as stop-loss or expense reimbursement coverage (mortgage disability, business overhead, key person, buy-sell, and numerous other schemes). Benefits can be provided in an indemnity fashion or lump sum, and can be triggered by meeting various definitions of total, partial, residual, or presumptive disability.

Regardless of the product features, plan design, or payor of benefits, disability insurance schemes typically have two outstanding features in common: they require that the economic loss, which is somehow to be compensated, be one which (1) arises from a medical condition and (2) produces a functional loss. The qualifying medical condition may be due to sickness or accident, illness or injury. Sometimes it may be congenital, and other times it must be acquired, or at least not preexisting, as the policy may define. Sometimes it must be deemed a permanent derangement, whereas in other cases, it must at least have a specified chronicity. The medical condition may reflect a "single" diagnosis (amputation, paralysis, etc.) or may be the result of multiple diagnoses and their additive or synergistic co-morbidities. *Table 2* lists some of the ways the medical component may be addressed.

The functional loss may also be described in a variety of ways — in terms of activities, duties, abilities, capacities, tasks, or roles, which are now precluded, or significantly interfered with, by the medical condition(s). The yardstick may be occupational (own occ, any occ, any gainful occ) with stipulated or implied reference to

reemployment in the prior work, local labor force or national economy. Alternatively a non-occupational yardstick such as ADL's (activities of daily living) may be used,⁵ or some other measurement of functional status. *Tables 3 and 4* list various ways in which occupational duties, and activities or functions, may be set forth.

Ultimately, the medical condition, and any impairment or functional loss it produces, needs to be related to some yardstick of requisite functional ability or capacity, with the final result being an administrative determination of the fulfillment of the applicable disability definition — or not. The weighing of available functional capacity (the residual or recoverable functional ability that the individual can supply) against duty or activity requirements (the threshold demands of occupational duties, ADL's etc., modified by whatever assistance or accommodation might be feasible) constitutes what is commonly called the "functional capacity assessment."⁶ The disability determination process, in general outline, looks something like *Table 5*.

A feature of most disability-determination processes in the U.S. is the initiation of the process by self-report. The patient/covered individual must feel he/she is entitled to "disability" and thus file notice. This implies that the person has already defined an invalid-role for himself or herself and formed at least the temporary belief that he or she is "disabled." A degree of self-interest necessarily develops that may involve other advocacy elements (family, treating physicians, support groups) leading to complex psychodynamics around disability decisions. People do not fit a purely mechanical model. While "disabled vehicle" euphemistically describes an incapacitated automobile that currently "doesn't" work because it "can't" work; human behavior can be a complex mixture of functional, motivational, and protective factors, and "not working" can be a mixture of "can't," "shouldn't," and "won't." The "cannot" (simplistically) would be a statement of functional limitation — what the person cannot do because he or she now lacks the capacity to do it. The "should not" (simplistically) would be a statement of functional restriction what the person ought not to do (for reasons amounting to medical necessity) because to do so would create risk of some imminent harm, to themselves, or sometimes to others, owing to their medical condition. The "won't" (simplistically) would be a statement of some motivational barrier to returning to prior occupation or activities. This last item is itself quite complex since a person may experience varying degrees of social stigma and secondary-gain from continuation in an invalid or sick-role status. Disability may equate to inability, or it may not.

As one social scientist has put it, disability is not something which is found in the person, but in that person's relationship to his or her environment, family, co-workers, employer, and work-activities.⁷ Full convalescence and maximal recovery are goals of disability care management, with return-to-work being an explicit part of the therapeutic goal-structure from early on wherever possible. Deliberate preparation — work hardening, work simulation, etc. — and transition management — part-time first-return, light duty, modified work, graded or structured re-entry, and other approaches — can facilitate the physical and psychological adjustment to returning to work.

One final distinction worth making is the relationship between the terms impairment, disability, and handicap. *Table 6* compares definitions used by the National Center for Health Statistics, World Health Organization, and American Medical Association. Not shown in the table is the definition of "disability" used in the ADA (1990) which was previously described in *Tables 2* and *4*. One may note that the ADA definition for "disability" is virtually identical to the definition of "handicapped" used by the U.S. government in its earlier Rehabilitation Act of 1975. As noted on page 1 of the AMA's Guides to the Evaluation of Permanent Impairment, "impairment, disability, and handicap appear in laws, regulations, and policies of diverse origin [in time and place] and without prior agreement on the ways in which they are to be used. It is no wonder that there is uncertainty, if not controversy, about the meaning of these words."⁸

In the absence of universal agreement on the semantics, the statistics for the frequency, distribution, and trends of various disabilities, and on incidence and recovery rates, can be difficult to obtain, or to compare. For what it's worth, the following estimates have been made.⁹ In 1988, 8.6% of persons aged 16-64 reported a work disability, and 4.8% indicated it was severe (census data). Approximately 20% described themselves as having a functional limitation, with 7.5% reporting it as severe.

The leading causes of activity limitation (all ages) included orthopedic impairments, arthritis, heart disease, visual impairments, intervertebral disk disorders, asthma, nervous disorders (including epilepsy, multiple sclerosis, Parkinson's disease, and other nervous disorders [exclusive of cerebrovascular disease], combined) and mental disorders (including alcohol and drug dependency, and senility, but not mental retardation).⁹

Conditions felt to have the "highest risk of disability" (all ages) included mental retardation, absence of leg(s), lung or bronchial cancer, multiple sclerosis, cerebral palsy, bilateral blindness, limb paralysis, orthopedic impairments, rheumatoid arthritis, intervertebral disk disorders, heart disease, digestive tract cancer, emphysema, hand or arm amputation or loss, and cerebrovascular disease.⁹ Among the targeted goals of U.S. health policy in the coming decade¹⁰ are "to reduce disability from chronic conditions to no more than 8%," "to reduce to no more than 90/1000 the proportion of people 65 and older who have difficulty performing two or more personal-care activities," and "to increase the years of healthy life to at least 65." There are five other goals pertaining to reducing the prevalence of "chronic disabling conditions" involving asthma, spine, vision, hearing, and mental retardation, and three additional goals for diabetes mellitus.

Some of the private insurance aspects of disability are amplified in other articles of this issue. Also, the reader might be interested in articles in previous issues of the *Journal*, notably Numbers 2 and 4 of Volume 23 (disability case management), Number 1 of Volume 23 (disability in Japan; workers compensation and brain injury), Volume 22, No. 3 (LTD reinsurance), and Volume 20, No. 3 (ID underwriting).

This discourse began by talking about morbidity, and now we will return full circle and close with it. As slippery and difficult as disability and morbidity are, both semantically and mensuratively, they remain important to attempt to quantify in some fashion. Mortality study has the luxury of a two-state model with no reversibility: living and dead (*Figure 1*). Morbidity and disability need to be modelled with multiple illness states (*Figure 1*), all except the last transition (to "dead") being potentially reversible and recursive. Despite this additional complexity, life-table methods,^{2,11-17} decision-trees, conditional probability and Markov processes,¹⁸ and Monte Carlo simulations each offer useful methodology and yield important data. For health and disability insurance, outcomes research, and effective social policy, these methods need to be marshaled and cultivated. It remains one of the commitments of the Academy's Committee on Morbidity and Mortality, and of this *Journal*, to promote such morbidity research and analysis.

Table 1

Given these variables ^a :	One can generally derive these statistics ^b :
1) r and r'	MR, EER
2) n , n' and E	MR, EER
3) R (or $P=1-R$) and r'	MR, EER
4) SIR and r or r'	EER
5) EER and r or r'	MR

(a) The information may be furnished in graphical, tabular or text (narrative) form in the original article, or in available life tables or incidence studies — some portions of which may need to be reconstructed or estimated. SIR = Standardized Incidence Rate, and EER = Excess Event Rate.

(b) In some cases, MR's and EER's will be derivable for both interval and mean data comparison, and in other cases, only for aggregate or geometric mean comparison. Details of actual process of stepwise derivation are well-described elsewhere.^{1,19,20}

Table 2

Various Ways in Which the Medical Component of Disability May be Defined

- arising from sickness or accident (illness or injury) and under the regular care of a physician/certifier. (Language like this or words to this effect appear in many types of individual and group disability [private insurance] coverages.)
- any medically-determinable physical or mental impairment which can be expected to last for a continuous period of not less than 12 months. (SSDI)²¹
- 1) any physiological disorder or condition, cosmetic disfigurement, or anatomic loss affecting one or more of the following body systems: neurological, musculoskeletal, special sense organs, respiratory, individual speech organs, cardiovascular, reproductive, digestive, genitourinary, hemic and lymphatic, skin, and endocrine, or
- 2) any mental or psychological disorder, such as mental retardation, organic brain syndrome, emotional or mental illness and specific learning disabilities. (ADA)²²

Table 3

Ways in Which Activities, Duties and Functions May be Variousy Described

- **job (work), or occupational duties:** job description (furnished by employee or employer), DOT (Dictionary of Occupational Titles) specs, delineation of duties, task or performance descriptions, list of essential functions of occupation.
- **activities of daily living (ADL's)⁵:** include such things as bathing, dressing, toileting, transfer, continence, feeding.
- **instrumental activities of daily living (IADL's):** include such things as shopping, housework, managing money, laundry, preparing meals, making phone calls, taking one's own medicine, getting around outside, and going places outside of walking distance.
- **major life activities (ADA)²³:** walking, talking, seeing, hearing, breathing, caring for one's self, learning, working, doing manual tasks, and participating in community activities.
- **functional capacities (many versions):** whether a person can engage in these activities, and if so, with what continuous duration, or repetitiveness: sitting, standing, and walking; bending, twisting, lifting, carrying, stooping, kneeling, climbing, grasping, pushing, pulling; etc.

Table 4
Examples of the Variety of Contractual and Legislative Definitions of Disability,
From the Occupational (occ) Perspective

- "own occ"
inability to perform the material and substantial duties of one's own occupation (e.g., type of definition common in individual disability policies and also used in many group disability coverages).
- "any occ"
inability to perform the duties of any occupation for which one is qualified by training, education, or experience (e.g., common in disability waiver-of-premium riders and in group disability coverages, after any "own occ" coverage period has expired).
- "any gainful occ"
inability to engage in any substantial gainful activity (e.g., Social Security Disability).²¹
- ADA²²
being limited in one or more of the major life activities of the individual, a record of such impairment, or being regarded as having such an impairment.

Table 5
General Components of Disability Determination

Case Identification:	self-report, self-filing
Medical Condition:	diagnostic labelling, sickness or accident, physical or psychological aspects
Impairment Assessment:	nature, severity, and implications of measurable or inferrable findings, extent of co-morbidities, degree of limitation and/or restriction
Prognostic Estimation:	probabilistic statements about future course and duration, permanency, recovery, rehab potential, etc.
Ongoing Evaluation:	one-time (presumptive) disability determination vs. periodic reassessment as to ongoing disability status

Table 6
Various Definitions of Impairment, Disability and Handicap

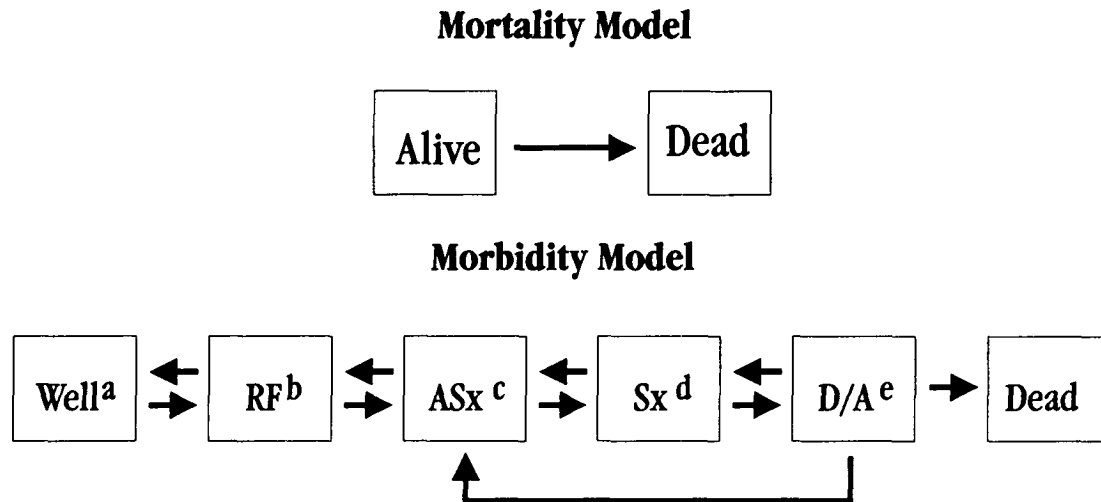
	NCHS ^a (1987)	WHO ^b (1980)	AMA ^c (1990)
Impairment	chronic or permanent defect, usually static in nature, that results from disease, injury, or congenital malformation	any loss or abnormality of psychological, physiological, or anatomic structure or function	the loss of, loss of use of, or derangement of, any body part, system, or function
Disability	any long- or short-term reduction of a person's activity as a result of an acute or chronic condition; limitation of ... capacity to perform his/her average kind or amount of activity associated with his/her age group	any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being	limiting loss or absence of capacity of an individual to meet personal, social, or occupational demands, or to meet statutory or regulatory requirements
Handicap	—	a disadvantage for a given individual, resulting from an impairment or disability, that limits or prevents the fulfillment of a role that is normal (depending on age, sex and social and cultural factors) for that individual	when a barrier or obstacle exists to the performance of a functional activity or life task such that it can only be overcome by being compensated for or accommodated in some way, often by the use of assistive devices; modification of the environment, modification of the tasks or activities, or some combination of these

(a) National Center for Health Statistics (Schoenborn).²⁴

(b) World Health Organization (ICIDH - international classification of impairments, disabilities, and handicaps).²⁵

(c) American Medical Association (Guides to the Evaluation of Permanent Impairment).⁸

Figure 1



- (a) Well, and free of any risk factors
 (b) Possessing risk factors
 (c) Asymptomatic disease
 (d) Symptomatic disease, but not "disabled" (morbidity)
 (e) Disabled, according to some definition (disability)

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