Dimensions of Ratings of Maternal and Neonatal Health Services: A Factor Analysis

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Dimensions of Ratings of Maternal and Neonatal Health Services: A Factor Analysis

Abstract

Ratings of the adequacy of national maternal and neonatal health programs, for 48 developing countries, are factor analyzed to determine the dimensions along which expert raters made their judgments. Up to 17 factors could be identified, largely paralleling the grouping of the 81 items in the questionnaire. Further analysis identified larger blocks of items, representing the capacity of health facilities, the extent of women's access to services, the care women receive, and policy and support services, plus a miscellaneous factor covering relatively rare service items. The various factor results were mostly interpretable and suggest that raters made careful judgments.

Dimensions of Ratings of Maternal and Neonatal Health Services

A scale has recently been introduced for obtaining expert ratings of maternal and neonatal health services in developing countries (Bulatao and Ross 2000). The scale, labeled the Maternal and Neonatal Program Index (MNPI), comprises 81 items descriptive of such services. Experts render judgments about how adequate a particular country program is on each item. The scale has been useful to describe and compare national services. In this paper we investigate the scale's statistical structure through factor analysis, in order to determine how cohesive the items are and whether they can be reduced, for descriptive as well as for analytical purposes, to a smaller set of dimensions.

Method

Ratings on the scale were obtained in 1999-2000 for national maternal and neonatal services in 48 developing countries, using 806 expert raters. However, only 415 raters completed all 81 items. (Similar ratings were obtained for services by state in India but are not considered here.) Raters, at least 10 per country, were recruited to represent diverse viewpoints and included government medical staff, university experts, nongovernmental and community experts, and in-country donor representatives. The average rater had eight years of experience with maternal services at the national level.

Items rated ranged from prenatal care to postnatal checkups, and included such disparate areas as management of postpartum hemorrhage, breastfeeding advice, care for sexually transmitted infections, in-service training for midwives and nurses, and budget adequacy. Each item was basically a descriptive statement about service adequacy, with which raters agreed or disagreed on a scale from 0 to 5. As in Bulatao and Ross (2000), we multiply these scores by 20 so that they run from 0 to 100, with higher scores indicating greater program adequacy. One group of items was slightly different, With regard to access to services, raters indicated the percentage of urban and rural women with adequate access. These scores also run from 0 to 100.

In the questionnaire, the items were grouped and ordered as follows:

"Maternal mortality and morbidity"
- Health center capacity, 7 items
- District hospital capacity, 3 items
- Access to services for pregnant rural women, 8 items
- Access to services for pregnant urban women, the same 8 items rated in parallel

"Maternal health"
- Antenatal care, 6 items

"Delivery and neonatal care"
- Delivery care, 7 items
- Newborn care, 6 items
- Family planning provision at health centers, 5 items
- Family planning provision at district hospitals, 6 items

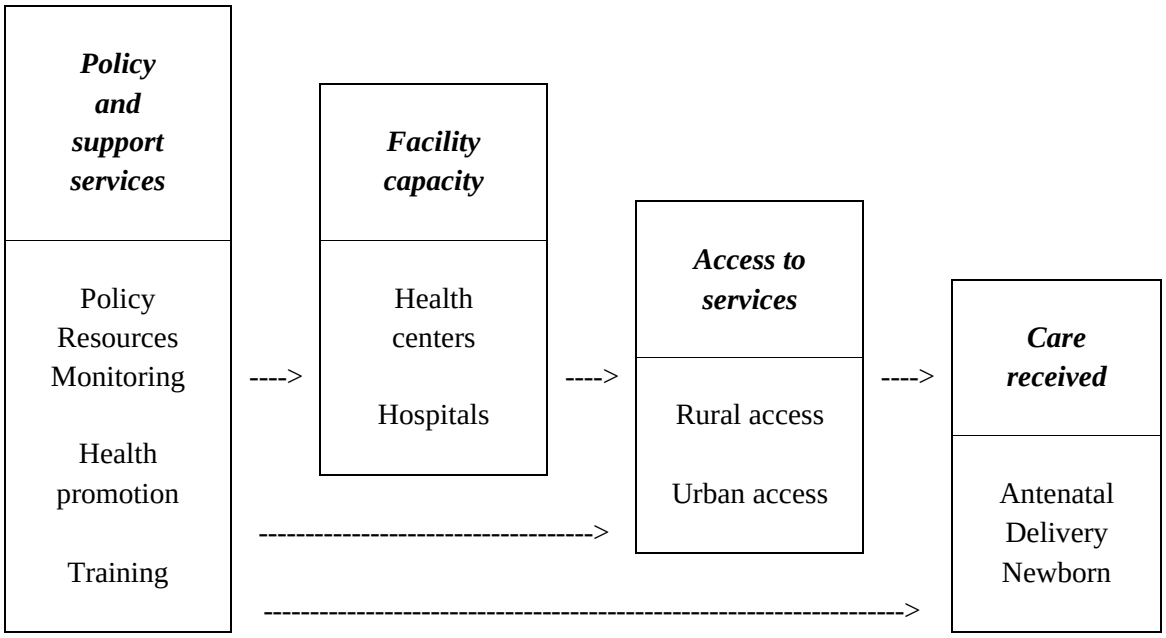
"General supporting functions"
- Policy, 7 items
- Resources, 3 items
- Health promotion, or information-education-communication, 4 items
- Training, 5 items
- Monitoring, evaluation, and research, 6 items.

The individual items are listed in Appendix A.

Bulatao and Ross (2000) suggested that the items fall naturally into the blocks indicated in Figure 1. The family planning items, which are not represented, were assumed to cut across the four main blocks. This framework was used in describing results across countries. Items could however be grouped in various alternative ways. For instance, the six antenatal care items might belong together with the items on rural and urban access to general antenatal care. Or the items on access to 24-hour hospitals might belong with the items on hospital capacity as well as with the items on family planning services in hospitals. Or all the items on abortion services, abortion complications, and abortion policy might belong together.

Given the variety of possible organizing principles, we do not start with specific hypotheses about the dimensionality of the scale but instead conduct exploratory factor analysis (Harman 1967). We extract principal components and apply varimax rotation to obtain orthogonal solutions. These analyses were conducted leaving out cases with missing data on any involved item.

Figure 1. Aspects of maternal health programs evaluated in the study



Note: Each block covers a variety of services in emergency care and other essential care, including such areas as immunization, nutrition, care for sexually transmitted infections, and family planning. A distinct set of items on family planning, cutting across these blocks, was included in the questionnaire.
Source: Bulatao and Ross (2000).

Results

Factor analyses across raters shows that 30 percent of the variance in the 81 items is captured in the first component (Table 1). Components 2-5 combined explain only 18 percent of the variance, and the remaining 12 components with eigenvalues of at least 1.0 explain 22 percent of the variance.

Varimax rotation of all components with eigenvalues greater than 1.0 (Table 2) results in orthogonal factors that, to a large extent, reflect the grouping of items in the questionnaire. Of the 14 clusters of questionnaire items listed above, 9 appear as distinct factors after orthogonal rotation. For each of these clusters, most items load primarily on the same factor, and no other items from other clusters load on that factor. These clusters are health center capacity (Factor 8) and hospital capacity (Factor 10); rural access (Factor 2) and urban access (Factor 4); antenatal care (Factor 11); and policy (Factor 3), monitoring (Factor 6), health promotion (Factor 7), and training (Factor 9). Two other clusters of items--delivery care and newborn care--appear combined in Factor 1.

The family planning items do not divide, as they do in the questionnaire, between clinic-based and hospital-based services. Instead they divide largely by contraceptive method. One factor represents abortion and postpartum family planning (Factor 5), another sterilization and IUDs (Factor 12), and a third contraceptive pills (Factor 13). Secondary loadings of at least .30 (Table 3) suggest some underlying affinity between the IUD and pill items and Factor 5. The item on female sterilization at hospitals, on the other hand, has a secondary loading on Factor 10, hospital capacity.

Table 1. Initial eigenvalues greater than 1.0 in factor analysis of maternal and neonatal services ratings

Compo-nent	*Initial eigenvalue*	*Cumulative percent of variance*
1	24.5	30.2
2	4.9	36.3
3	4.1	41.4
4	2.9	45.0
5	2.5	48.2
6	2.4	51.2
7	2.0	53.7
8	1.8	55.9
9	1.7	58.1
10	1.6	60.0
11	1.4	61.8
12	1.3	63.3
13	1.2	64.8
14	1.2	66.3
15	1.1	67.7
16	1.1	69.0
17	1.0	70.3

Note: Total n = 415.

Table 2. Primary loading of each item after orthogonal rotation of 17 factors

Factor 1	*Loading*	*Factor 2*	*Loading*	*Factor 3*	*Loading*
Newborn care		**Rural access**		**Policy**	
Clean cord cut	0.76	Obstructed labor	0.82	Consultation	0.74
Immunization sked	0.68	Postpartum hemorrhage	0.81	High-level review	0.70
DPT injection	0.68	Abortion complications	0.79	Ministry policy	0.70
Drying and warming	0.68	Delivery care	0.71	Statements of support	0.64
Mouth clearing	0.67	Postpartum fp	0.66	Personnel can act	0.64
Eye prophylaxis	0.61	Abortion services	0.61	Abortion complications	0.62
Delivery care		Antenatal care	0.57	Director level	0.61
Umbilical cord info	0.71			**Resources**	
Hypertension check	0.62			Budget	0.46
Breastfeeding info	0.61				
Emergency care	0.55				
Trained attendant	0.50				
Factor 4	*Loading*	*Factor 5*	*Loading*	*Factor 6*	*Loading*
Urban access		**Fp at hospitals**		**Monitoring**	
Obstructed labor	0.81	Postabortion fp	0.74	Decisions use statistics	0.72
Postpartum hemorrhage	0.78	Postpartum fp	0.73	Facility listing	0.71
Abortion complications	0.77	**Fp at health centers**		Survey data	0.67
Delivery care	0.75	Postpartum fp	0.69	Statistics monitored	0.66
Antenatal care	0.70	Postabortion fp	0.69	Statistical reports	0.56
Postpartum fp	0.54			Case-fatality reviews	0.56
Abortion services	0.50				
Factor 7	*Loading*	*Factor 8*	*Loading*	*Factor 9*	*Loading*
Health promotion		**Health center capacity**		**Training**	
Media on bad customs	0.79	Retained placenta	0.81	Refresher training	0.73
Media on complications	0.76	Intravenous antibiotics	0.69	Refresher for MDs	0.71
Community organizations	0.68	Partograph	0.65	New provider training	0.61
Materials	0.57	Postpartum hemorrhage	0.58	New MD training	0.54
Resources		Manual vacuum aspiration	0.58	Curricula	0.50
Private sector	0.46	Antibiotic supplies	0.45		
Factor 10	*Loading*	*Factor 11*	*Loading*	*Factor 12*	*Loading*
Hospital capacity		**Antenatal care**		**Fp at hospitals**	
Caesarian section	0.77	Iron folate	0.69	Female sterilization	0.60
Transfusions	0.73	Tetanus injections	0.66	Male sterilization	0.55
Health center functions	0.64	Hypertension check	0.58	IUD insertion	0.53
		Syphilis check	0.48	**Fp at health centers**	
		Info on danger signs	0.47	IUD insertion	0.47

Factor 13	*Loading*	*Factor 14*	*Loading*	*Factor 15*	*Loading*
Fp at hospitals		**Delivery care**		**Resources**	
Pill supplies	0.57	48-hour checkup	0.50	Free services	0.61
Fp at health centers		Labor monitoring	0.49	**Antenatal care**	
Pill supplies	0.55			HIV counseling	0.44
Progestin pill	0.55			**Health center capacity**	
				Transport	0.34
Factor 16	*Loading*	*Factor 17*	*Loading*		
Rural access		*no item had a primary loading on this factor*			
24-hour hospitals	0.70				
Urban access					
24-hour hospitals	0.63				

Note: Fp is used as an abbreviation for family planning.

The resources cluster does not appear as a coherent factor. Its three items are dispersed: budget adequacy is linked to the policy cluster, private sector services to the health promotion cluster, and free services to an anomalous collection of items (Factor 15). This collection includes, besides free services, antenatal HIV counseling and transport availability at health centers. These three items have little in common other than being among the lowest rated aspects of programs.

There are, finally, two factors that appear to represent anomalous items that have fallen out of otherwise coherent clusters. One (Factor 14) mainly involves two delivery care items: scheduling a 48-hour checkup and monitoring labor. These are the lowest rated aspects of delivery care and involve keeping track of a patient's situation rather than actually intervening. Both items have secondary loadings of at least .30 on the main delivery care-newborn care factor (Factor 1), and some of the other delivery care items have secondary loadings on Factor 14. This suggests that raters still see some link between these two items and other aspects of delivery care.

The other somewhat anomalous factor (Factor 16) involves access, both rural and urban, to 24-hour hospitals. Both the concept and phrasing of these items may be somewhat confusing (see Bulatao and Ross 2000:Appendix B); raters may be interpreting it in inconsistent ways. Each item does have a secondary loading on the main rural access or urban access factor (Factors 2 and 4), suggesting that some affinity with the other access items still exists.

Secondary loadings for each item of at least .30 are shown in Table 3. While not all of these are clearly interpretable, many are, and these suggest the nuanced interpretations raters have made:

- Particular items on antenatal care that have to do with averting or anticipating emergencies have secondary loadings on Factor 1, which includes delivery care items relating to dealing with emergencies.

- Three of the four health promotion items, as well as the monitoring item that concerns making decisions using statistics, have secondary loadings on Factor 3, which involves policy. Health promotion is largely driven by public policy in many developing countries, rather than constituting a separate industry.

Table 3. Secondary loadings of at least .30 after rotation of 17 factors

Factor 1	*Loading*	*Factor 2*	*Loading*	*Factor 3*	*Loading*
Delivery care		**Rural access**		**Health promotion**	
Labor monitoring	0.38	24-hour hospitals	0.37	Media on complications	0.33
48-hour checkup	0.35	**Urban access**		Media on bad customs	0.31
Antenatal care		Abortion services	0.33	Materials	0.31
Tetanus injections	0.35	**Fp at hospitals**		**Fp at health centers**	
Hypertension check	0.35	Male sterilization	0.32	Pill supplies	0.32
Info on danger signs	0.33			**Fp at hospitals**	
Training				Pill supplies	0.32
Curricula	0.32			**Training**	
Fp at health centers				Curricula	0.30
Postpartum fp	0.30			**Monitoring**	
				Decisions use statistics	0.30

Factor 4	*Loading*	*Factor 5*	*Loading*		*Loading*
Urban access		**Fp at health centers**		**Urban access**	
24-hour hospitals	0.56	IUD insertion	0.43	Postpartum fp	0.38
		Pill supplies	0.36	**Antenatal care**	
		Fp at hospitals		Syphilis check	0.35
		Pill supplies	0.40	**Rural access**	
		IUD insertion	0.36	Postpartum fp	0.30

Factor 6	*Loading*	*Factor 7*	*Loading*	*Factor 8*	*Loading*
Training		**Policy**		**Training**	
New MD training	0.36	Statements of support	0.36	Transport	0.33

Factor 10	*Loading*	*Factor 11*	*Loading*	*Factor 12*	*Loading*
Fp at hospitals		**Resources**		**Rural access**	
Female sterilization	0.39	Private sector	0.31	Abortion services	0.35

Factor 14	*Loading*	*Factor 15*	*Loading*	*Factor 17*	*Loading*
Delivery care		**Resources**		**Urban access**	
Trained attendant	0.43	Budget	0.34	Postpartum fp	0.34
Hypertension check	0.39	**Antenatal care**			
Emergency care	0.37	Info on danger signs	0.33		
Training		**Health center capacity**			
New provider training	0.33	Antibiotic supplies	0.30		
New MD training	0.31				
Health center capacity					
Transport	0.32				

- The policy item regarding frequent public statements of support for safe pregnancy, on the other hand, has a secondary loading on Factor 7, the health promotion factor.

- The items on rural and urban access to postpartum family planning both have secondary loadings on Factor 5, the family planning factor that involves such services.

- The items on new-provider training have secondary loadings on Factor 14, the factor concerning monitoring and follow-up of deliveries. This suggests that these aspects of delivery care are less common and require training to instill their importance.

To obtain a more compact set of dimensions, we reduce the number of factors rotated to five. This produces larger clusters of items (Table 4) that largely parallel the major blocks represented in Figure 1. The first factor involves care received (antenatal, delivery, and newborn); the second, access to services (rural and urban); the third, policy and support services (policy, resources, monitoring, health promotion, and training); and the fourth, facility capacity (health centers and hospitals).

The items loading primarily on the fifth factor are a melange. The one common thread here is that all these items are relatively rare in maternal health programs, being rated near the bottom across countries. In fact, all the other items that are rated as low or lower than these have secondary loadings (not shown) of at least .30 on the fifth factor. This factor therefore appears to represent innovativeness in programs, in the sense of programs that push the prevailing limits in the services they provide.

Consistent with Figure 1, the family planning items do not define a separate factor, some being related to facility capacity, others to care received, and the last one to service access.

The analysis so far has involved only half the raters, because the other half missed at least one item each. To examine results with a larger part of the sample, we analyze items in blocks as indicated in Figure 1 (adding a family planning block for completeness), which allows us to include all raters who completed each block of items. It also allows us to investigate the structure of particular blocks of items in more detail.

Each block comprises between 10 and 25 items. The first component extracted accounted for 40-52 percent of the variance in each block. Between 2 and 4 components had eigenvalues greater than 1.0 for each block, accounting together for 56-77 percent of the variance. Rotating factors to orthogonality gives results largely in line with preceding results, indicating that raters who skipped items still responded to the scale in a manner broadly similar to that of raters who answered all items. Some finer distinctions among items also appear, however.

As in Table 2, analysis of facility capacity items distinguishes two rotated factors, for health center capacity and district hospital capacity (Table 5). However, two items referring to health centers--transport for emergencies and antibiotic supplies--prove to have largely equivalent loadings on both rotated factors. While these items must exist at the health center level, their provision is perhaps more of a continuing responsibility for district management, which must provide the facilities to which patients are transported as well as the antibiotics that end up at the health centers.

Table 4. Primary loading of each item after rotation of five factors

Factor 1	*Loading*	*Factor 2*	*Loading*	*Factor 3*	*Loading*
Delivery care		**Urban access**		**Health promotion**	
Hypertension check	0.75	Postpartum hemorrhage	0.77	Media on complications	0.70
Umbilical cord info	0.71	Obstructed labor	0.75	Media on bad customs	0.70
Emergency care	0.66	Abortion complications	0.74	Materials	0.68
Breastfeeding info	0.65	Delivery care	0.71	Community organizations	0.64
Trained attendant	0.61	Antenatal care	0.68	**Monitoring**	
Labor monitoring	0.54	Postpartum fp	0.67	Statistics monitored	0.67
Newborn care		Abortion services	0.60	Decisions use statistics	0.64
Clean cord cut	0.74	24-hour hospitals	0.58	Statistical reports	0.58
Drying and warming	0.65	**Rural access**		Case-fatality reviews	0.53
Immunization sked	0.65	Postpartum hemorrhage	0.68	Survey data	0.50
Eye prophylaxis	0.62	Obstructed labor	0.68	Facility listing	0.48
DPT injection	0.61	Postpartum fp	0.66	**Policy**	
Mouth clearing	0.58	Abortion complications	0.66	Statements of support	0.63
Antenatal care		Delivery care	0.63	High-level review	0.61
Hypertension check	0.56	Antenatal care	0.57	Consultation	0.58
Tetanus injections	0.55	Abortion services	0.57	Ministry policy	0.55
Syphilis check	0.54	24-hour hospitals	0.53	Abortion complications	0.52
Info on danger signs	0.49	**Fp at hospitals**		Personnel can act	0.46
Iron folate	0.41	Female sterilization	0.40	Director level	0.38
Fp at health centers				**Resources**	
Postpartum fp	0.54	*Factor 4*	*Loading*	Budget	0.56
Postabortion fp	0.48	**Health center capacity**		Private sector	0.34
Fp at hospitals		Retained placenta	0.61	**Training**	
Postabortion fp	0.48	Postpartum hemorrhage	0.59	New MD training	0.54
Postpartum fp	0.45	Intravenous antibiotics	0.54	Refresher for MDs	0.48
		Partograph	0.52	Refresher training	0.47
		Antibiotic supplies	0.49	Curricula	0.38
		Manual vacuum aspiration	0.44		
		Transport	0.42	*Factor 5*	*Loading*
		Hospital capacity		**Training**	
		Transfusions	0.51	New provider training	0.49
		Health center functions	0.50	**Delivery care**	
		Caesarian section	0.49	48-hour checkup	0.44
		Fp at health centers		**Antenatal care**	
		IUD insertion	0.49	HIV counseling	0.42
		Pill supplies	0.47	**Fp at hospitals**	
		Progestin pill	0.43	Male sterilization	0.38
		Fp at hospitals		**Resources**	
		Pill supplies	0.44	Free services	0.33
		IUD insertion	0.43		

Table 5. Rotated factor matrix for items on facility capacity

Group	*Item*	*1*	*2*
Health centers:	Retained placenta	**0.81**	0.10
Health centers:	Intravenous antibiotics	**0.71**	0.10
Health centers:	Postpartum hemorrhage	**0.70**	0.30
Health centers:	Partograph	**0.61**	0.22
Health centers:	Manual vacuum aspiration	**0.59**	0.06
Health centers:	Antibiotic supplies	**0.48**	0.46
Hospitals:	Caesarian section	0.05	**0.86**
Hospitals:	Transfusions	0.12	**0.86**
Hospitals:	Health center functions	0.23	**0.80**
Health centers:	Transport	0.38	**0.50**

Note: Primary loadings in boldface.

Table 6. Rotated factor matrix for items on access to services

Group	*Item*	*1*	*2*	*3*	*4*
Urban:	Obstructed labor	**0.86**	0.24	0.23	0.07
Urban:	Postpartum hemorrhage	**0.83**	0.29	0.24	0.08
Urban:	Abortion complications	**0.81**	0.26	0.28	0.04
Urban:	Delivery care	**0.77**	0.33	0.05	0.22
Urban:	Antenatal care	**0.67**	0.28	0.02	0.43
Rural:	Obstructed labor	0.26	**0.83**	0.31	0.05
Rural:	Postpartum hemorrhage	0.27	**0.81**	0.30	0.09
Rural:	Delivery care	0.32	**0.79**	0.07	0.18
Rural:	Abortion complications	0.25	**0.76**	0.40	0.05
Rural:	Antenatal care	0.33	**0.68**	-0.11	0.33
Rural:	Postpartum fp	0.20	**0.56**	0.49	0.19
Urban:	Abortion services	0.31	0.08	**0.82**	0.11
Rural:	Abortion services	0.04	0.40	**0.81**	0.15
Urban:	Postpartum fp	0.48	0.18	**0.49**	0.17
Rural:	24-hour hospitals	-0.01	0.34	0.20	**0.82**
Urban:	24-hour hospitals	0.42	-0.01	0.17	**0.80**

As in Table 2 also, analysis of access items (Table 6) distinguishes one factor having to do with urban access and a second having to do with rural access. Not all items load primarily on these two factors, however. Access to 24-hour hospitals involves a separate factor. Access to abortion (though not to treatment for abortion complications) and access to postpartum family planning also involve a separate factor.

Factor results for the items relating to care received are somewhat complicated (Table 7). The three rotated factors appear mainly to represent newborn care, delivery care, and antenatal care. There is, however, some overlap. Two of the items under delivery care are encouragement of breastfeeding and

information on umbilical cord care. Both these items fit slightly better with the newborn care items than with the other delivery care items. This is understandable if you take the newborn care items to involve the welfare of the child as opposed to the welfare of the mother. In addition, one antenatal care item (HIV counseling) and one newborn care item (eye prophylaxis) fit better with the delivery care items. One interpretation is that the factor representing delivery care actually represents the relatively rare services within this block, including these two and such delivery services as 48-hour checkups.

We expect, from the preceding analysis, that the family planning items will divide by method rather than between family planning at health centers and family planning at hospitals. That is in fact what Table 8 indicates.

We expect also that the policy and support services block would mostly divide into appropriate groups, except for the resources items. Table 9 confirms this. The resources items relate to separate factors: budgetary adequacy is linked to policy, private sector effort to health promotion, and free services to training. In addition, we see that one training item, concerning whether the medical curriculum includes hands-on obstetric training, is related more to policy than to the other training items.

Table 7. Rotated factor matrix for items on care received

Group	*Item*	*1*	*2*	*3*
Newborn:	DPT injection	**0.82**	0.07	0.19
Newborn:	Immunization sked	**0.80**	0.12	0.24
Newborn:	Clean cord cut	**0.71**	0.40	0.10
Newborn:	Drying and warming	**0.60**	0.40	0.18
Newborn:	Mouth clearing	**0.59**	0.42	0.17
Delivery:	Breastfeeding info	**0.58**	0.31	0.36
Delivery:	Umbilical cord info	**0.56**	0.44	0.31
Delivery:	48-hour checkup	0.22	**0.73**	0.10
Delivery:	Emergency care	0.43	**0.67**	0.25
Delivery:	Labor monitoring	0.39	**0.66**	0.23
Delivery:	Trained attendant	0.45	**0.66**	0.15
Delivery:	Hypertension check	0.50	**0.61**	0.29
Antenatal:	HIV counseling	-0.03	**0.59**	0.29
Newborn:	Eye prophylaxis	0.42	**0.55**	0.11
Antenatal:	Tetanus injections	0.39	0.01	**0.75**
Antenatal:	Iron folate	0.13	0.11	**0.74**
Antenatal:	Hypertension check	0.28	0.39	**0.66**
Antenatal:	Info on danger signs	0.20	0.45	**0.59**
Antenatal:	Syphilis check	0.09	0.47	**0.57**

Table 8. Rotated factor matrix for items on family planning provision

Group	*Item*	*1*	*2*	*3*
At health centers:	Postabortion fp	**0.84**	0.18	0.19
At hospitals:	Postabortion fp	**0.82**	0.25	0.21
At health centers:	Postpartum fp	**0.82**	0.23	0.18
At hospitals:	Postpartum fp	**0.78**	0.31	0.20
At health centers:	Pill supplies	0.29	**0.80**	0.24
At hospitals:	Pill supplies	0.26	**0.79**	0.25
At health centers:	Progestin pill	0.19	**0.75**	0.06
At hospitals:	Female sterilization	0.16	0.13	**0.87**
At hospitals:	Male sterilization	0.13	0.07	**0.78**
At hospitals:	IUD insertion	0.31	0.39	**0.63**
At health centers:	IUD insertion	0.42	0.34	**0.54**

Table 9. Rotated factor matrix for items on policy and support services

Group	*Item*	*1*	*2*	*3*	*4*
Policy:	Consultation	**0.73**	0.19	0.30	0.04
Policy:	Ministry policy	**0.72**	0.20	0.13	0.20
Policy:	High-level review	**0.71**	0.23	0.22	0.23
Policy:	Personnel can act	**0.70**	0.18	0.27	0.05
Policy:	Director level	**0.66**	0.15	0.06	0.12
Policy:	Abortion complications	**0.60**	0.18	0.27	0.14
Policy:	Statements of support	**0.54**	0.21	0.44	0.16
Resources:	Budget	**0.49**	0.13	0.31	0.37
Training:	Curricula	**0.43**	0.32	-0.06	0.32
Monitoring:	Survey data	0.16	**0.73**	0.05	0.12
Monitoring:	Statistics monitored	0.32	**0.73**	0.28	0.14
Monitoring:	Facility listing	0.17	**0.68**	0.27	0.11
Monitoring:	Decisions use statistics	0.33	**0.67**	0.24	0.24
Monitoring:	Statistical reports	0.22	**0.66**	0.24	0.21
Monitoring:	Case-fatality reviews	0.18	**0.56**	0.24	0.44
Health promotion:	Media on bad customs	0.26	0.19	**0.84**	0.12
Health promotion:	Media on complications	0.28	0.17	**0.80**	0.15
Health promotion:	Community organizations	0.15	0.26	**0.69**	0.23
Health promotion:	Materials	0.35	0.27	**0.57**	0.33
Resources:	Private sector	0.24	0.12	**0.34**	0.10
Training:	Refresher for MDs	0.19	0.25	0.08	**0.77**
Training:	Refresher training	0.26	0.25	0.11	**0.71**
Training:	New provider training	0.01	0.24	0.38	**0.70**
Training:	New MD training	0.00	0.29	0.37	**0.66**
Resources:	Free services	0.23	-0.06	0.06	**0.55**

Discussion

The questionnaire ordered the items in a particular way, separating "maternal mortality and morbidity," for instance, from "maternal health." These broad distinctions did not resonate with the raters. Instead, factor analysis of their responses leads to distinguishing the four main blocks of items represented in Figure 1. Each of these blocks emerges as a distinct factor, and the one set of items not represented as a block--on family planning--does not appear as a separate factor,

The four blocks represent distinct ways of looking at services. From the perspective of the service provider, one might distinguish input and potential output: the support they receive from the rest of the health system (by way of policy, training, etc.) or the services they have the capacity to provide. From the perspective of the patient, one might distinguish potentiality from actuality: the degree of access they have to whatever services are provided or the care they actually receive. Apparently raters recognize such distinctions and respond to the items accordingly.

At a more disaggregated level, most groups of items distinguished in the questionnaire are also distinguished in factor analysis. Health center capacity is distinguished from hospital capacity, rural access from urban access, and antenatal care from delivery care. Policy, monitoring, health promotion, and training are each distinguished. Newborn care is also distinguished from delivery care, though not completely and not in all of the analyses.

The groups of items that are not distinguished in the factor analyses are the family planning items and the resources items. The family planning items divide, not between health center services and hospital services, but basically by contraceptive method. The resources items relate separately to different factors, probably reflecting the diversity of this small set.

While the results are generally consistent with a priori categories for the items, some individual items do not belong to the expected categories. The distinction between health center and hospital functions is not perfect for those functions that link the two together, such as transport. Similarly, the distinction between delivery care and newborn care is imperfect. Items such as breastfeeding and umbilical cord care may have been misclassified under delivery rather than newborn care. Finally, some access items, particularly having to do with access to 24-hour hospitals and to abortion and postpartum family planning, could be considered separate dimensions.

On one hand, these results confirm the structure that has been used in describing the ratings so far (Figure 1) and suggest that further analysis can utilize these distinctions. On the other hand, the results suggest various refinements that could be made in constructing indices from these data. Overall, the factor analysis suggests that ratings, far from being arbitrary, reflect careful judgments, distinctions, and comparisons among the items, suggesting that raters took their task seriously and performed it with care.

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Appendix A: Item Labels [in brackets] and Questionnaire Items

Maternal mortality and morbidity

I. All health centers have trained staff, in place, who can provide obstetric care:

1. [Postpartum hemorrhage] Manage postpartum hemorrhage cases
2. [Intravenous antibiotics] Administer antibiotics intravenously
3. [Retained placenta] Perform manual removal of retained placenta
4. [Manual vacuum aspiration] Perform vacuum aspiration of the uterus, using MVA (manual vacuum aspiration) or an electric suction device
5. [Partograph] Use a partograph to determine when to refer
6. [Transport] Have transportation arrangements to quickly move a woman with obstructed labor to a district hospital
7. [Antibiotic supplies] Have adequate antibiotic supplies on hand (sufficient supplies of the correct types)

II. All first referral facilities--district hospitals--have trained staff, in place, who can:

8. [Health center functions] Provide all functions listed above for Health Centers
9. [Transfusions] Perform blood transfusions (and have adequate supplies of safe blood on hand)
10. [Caesarian section] Perform Cesarean section or other operative delivery (e.g. forceps delivery or craniotomy)

IIIa. What percentage of pregnant (rural) women have adequate access to:

11. [Postpartum hemorrhage] Treatment for postpartum hemorrhage during or soon after delivery
12. [Obstructed labor] Management of obstructed labor
13. [Abortion complications] Treatment of abortion complications
14. [Abortion services] Provision of safe abortion services, or menstrual regulation
15. [Antenatal care] Antenatal care during pregnancy
16. [Delivery care] Delivery care by a trained professional attendant
17. [Postpartum fp] Postpartum family planning services
18. [24-hour hospitals] District hospitals that are open 24 hours/day

IIIb. What percentage of pregnant (urban) women have adequate access to:

19. [Postpartum hemorrhage] Treatment for postpartum hemorrhage during or soon after delivery
20. [Obstructed labor] Management of obstructed labor
21. [Abortion complications] Treatment of abortion complications
22. [Abortion services] Provision of safe abortion services, or menstrual regulation
23. [Antenatal care] Antenatal care during pregnancy
24. [Delivery care] Delivery care by a trained professional attendant
25. [Postpartum fp] Postpartum family planning services
26. [24-hour hospitals] District hospitals that are open 24 hours/day

Maternal health

IV. At antenatal visits, all pregnant women:

27. [Iron folate] Receive iron folate tablets for anemia
28. [Hypertension check] Are both examined for hypertension, and treated as needed
29. [Syphilis check] Are both examined for syphilis, and treated as needed
30. [Tetanus injections] Receive needed tetanus injection(s)
31. [Info on danger signs] Are informed about danger signs of obstetric and newborn complications and are assisted in planning for any emergency
32. [HIV counseling] Are offered voluntary counseling and testing for HIV

Delivery and neonatal care

V. At delivery, all pregnant women:

33. [Trained attendant] Are seen by a professionally trained attendant (either at home or in a facility)
34. [Labor monitoring] Have their labor monitored
35. [Hypertension check] Are checked for signs of hypertension, anemia, or infection
36. [Emergency care] Are able to receive emergency obstetric care as needed
37. [48-hour checkup] Are provided an appointment for a check-up within 48 hours of delivery
38. [Breastfeeding info] Are encouraged to immediately start breastfeeding their newborn
39. [Umbilical cord info] Are counseled on umbilical cord care

VI. For newborn care, all infants whether delivered at home or in a facility:

40. [Mouth clearing] Have their mouth and nasal passageways cleared
41. [Drying and warming] Are dried and kept warm immediately after birth
42. [Eye prophylaxis] Receive prophylactic treatment for their eyes.
43. [Clean cord cut] Have their umbilical cord cut with a clean blade
44. [DPT injection] Receive a DPT injection at 3 months
45. [Immunization sked] Are scheduled for subsequent immunizations

Provision of family planning

VII. All health centers:

46. [Postabortion fp] Routinely offer family planning after abortion cases
47. [Postpartum fp] Routinely offer family planning at postpartum visits
48. [Pill supplies] Have contraceptive pill supplies regularly in stock
49. [Progestin pill] Have progestin-only pill supplies for breast-feeding women
50. [IUD insertion] Have trained staff, in place, who can insert intra-uterine devices

VIII. All first referral facilities--district hospitals:

51. [Postabortion fp] Routinely offer family planning after abortion cases
52. [Postpartum fp] Routinely offer family planning at postpartum visits
53. [Pill supplies] Have contraceptive pill supplies regularly in stock
54. [IUD insertion] Have trained staff, in place, who can insert intra-uterine devices

55. [Female sterilization] Can offer sterilization to female clients
56. [Male sterilization] Can offer sterilization to male clients

General supporting functions

IX. Policies toward safe pregnancy and delivery

57. [Ministry policy] Ministry of Health policies toward pregnancy and delivery services are adequate
58. [Consultation] Policies are developed through adequate consultation with interested parties such as other ministries, NGOs, private practitioners, women's groups
59. [Personnel can act] Policies are reasonable and fair concerning which personnel can provide maternal health services (e.g. trained midwives can perform a wide range of medical procedures)
60. [Abortion complications] A favorable policy exists toward the treatment of complications of abortions, including complications seen from illegal abortions
61. [High-level review] Policies are vigorously implemented through regular high-level reviews and updated action plans
62. [Director level] The director of services for maternal health is placed at a high administrative level
63. [Statements of support] High officials in the government, including the Ministry of Health, issue frequent statements to the press and public to support improvements for safe pregnancy and delivery

X. Resources

64. [Budget] The government budget for safe pregnancy, delivery, and postpartum care (for facilities, personnel, supplies, etc.) is adequate for the needs, whether from the Ministry of Health, provincial government or donor support
65. [Free services] All services and drugs are provided free to all clients
66. [Private sector] The private sector (doctors, midwives, clinics, maternity homes) is active and covers a substantial share of pregnancy and delivery cases

XI. Information, education, communication

67. [Media on complications] The national program uses the mass media to educate the public about symptoms of pregnancy complications and safe places for childbirth
68. [Media on bad customs] Also, the national program uses the mass media to educate the public about harmful home practices for pregnancy care, delivery, and postpartum care (home remedies and birthing customs, etc.)
69. [Community organizations] Community-level organizations take part in systematic programs to educate the public about safe pregnancy and delivery
70. [Materials] The Ministry of Health supplies adequate educational materials (posters, pamphlets, etc.) to delivery facilities to instruct clients about safe practices

XII. Training arrangements

71. [Curricula] Medical curricula include hands-on clinical training in obstetric care, including management of several deliveries

72. [Refresher training] All midwives and nurses in health centers have received refresher training for safe pregnancy and delivery care within the last 5 years

73. [Refresher for MDs] Doctors in health centers have received refresher training for safe pregnancy and delivery care within the last 5 years
74. [New provider training] Newly hired midwives and nurses for health centers receive training for safe pregnancy and delivery care within the first 6 months
75. [New MD training] Newly hired doctors receive special in-service training for normal deliveries

XIII. Monitoring, evaluation, research

76. [Statistical reports] A routine statistical system (using facility-based information) provides good periodic information on supplies, personnel, deliveries, Cesarean sections, and cases of complications
77. [Statistics monitored] Staff at the national level regularly monitor and analyze results from the routine statistics (above)
78. [Survey data] Recent surveys provide data on maternal events (pregnancies, deliveries, attendants and sites for deliveries, estimates of maternal deaths, etc.)
79. [Facility listing] An updated listing exists of facilities that can treat obstetric emergencies
80. [Decisions use statistics] Ministry administrators systematically use statistical information for decisions and reconsideration of strategies for reducing maternal mortality
81. [Case-fatality reviews] Each hospital follows a regular procedure to review and learn from every case of a maternal death in the facility