Organizational Waves

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1. Seasonal Variation: A Problem of Meaning

The Korean Family Planning Program has been in active operation for well over a decade. During that time it has recruited more than two million IUD acceptors, more than 200,000 sterilization acceptors, and more than 700,000 users of oral contraceptive pills (Kim, Ross, Worth, 1972 p. 215-16, and Nortman, 1974, p. 62). During the decade of the 1960's the total fertility rate dropped by 23%, from 5,525 to 4,480, and the age-specific fertility rate dropped in every age group except the 25-29 year group. The declines in the age groups under 20 and over 35 have been between 40% and 68%. Korea is one of the very few countries in the world in which it can be effectively demonstrated that the family planning program has had a unique and powerful impact in the direction of reducing fertility (Lapham, 1972 and Kim, Ross, and Worth, 1972 p. 169/70).

Organizationally, the program is well beyond the first generation problems of creating a structure and putting effective work into that structure. There is a distinct family planning section within the Ministry of Health and Social Affairs. It has effective links to a specialized institute for research and training, and to such private organizations as the Planned Parenthood Federation of Korea. There has been extensive research on the general demographic problem, on the acceptors of program services, and on the organizational structure of the program itself. The program can now be said to face a series of second generation problems, in which policy makers focus upon more refined adjustments to more subtle

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problems both in the population of acceptors and in the organization itself. One of these problems is ***seasonal variation.***

For some years the Korean family planning administrators have been aware of a distinct seasonal variation in their program's activities. Numbers of acceptors by various methods show pronounced high and low periods at different times of the year. There is considerable uncertainty about the meaning and the cause of this seasonal variation, but there is a strong sense that it represents some weakness or irrationality in the program. Much of the seasonal variation is perceived to result from "adjustments" in local health center reporting, which make the service statistics of the program inaccurate indicators of real program activity. Thus George Worth, reporting on specific efforts made by program administrators to smooth the variations, reflects as follows on the only partial success of the effort. "If the service statistics of the Korean Family Planning Program are to be used in the analysis of actual activities, some greater effort must be made to persuade local government units to cooperate with the effort to increase health center reporting ***on time***" (Worth, March 1974, p. 3, italics added).

A 1973-1974 ESCAP (then ECAFE) study of Korean family planning administration in which the two authors participated (Kim, 1974), also identified the distinct seasonal pattern, but raised very different questions about its meaning. That study noted a single wave over a twelve-month period and found that the amount of seasonal varition was ***positively*** related to a measure of ***clinic efficiency*** in the rural clinics. This raised the possibility that at the level of the local clinic the seasonal variation represented same rational and efficient adjustment to the environment in which the clinic operated.

Although these two observation efforts do not speak directly to one another, they do point to two quite different possible interpretations of the seasonal variation. One sees it as a reflection of inefficiency that is to be overcome by tighter or more effective administration. The other raises the possibility that the variation represents an efficient orgainzational adjustment to external conditions, and perhaps should be encouraged or at least accepted by central administrators.

The possibility of these two quite different interpretation simply sharpens the question: what does the seasonal variation mean? This paper makes a preliminary attempt to answer this question.

We shall proceed by first making a visual presentation of the overall patterns of monthly variation for a period of a few years. These presentations show the types of seasonality the oveall program experienced. Then we shall present three general areas of explanation for the observed seasonality. These are explanations suggested by administrators and knowledgeable observers of the program. Finally we shall proceed to test these explanations by developing a measure for the variation and then attempting to identify correlates of variation, using measures relevant to the general areas of explanation.

2. Seasonal Variation: The Korean Experience 1969-1974

The month-to-month variations in reported aggregate program activity are shown in figures 1 through 7. These show six different program output measures and one input measure for the 57-month period July 1969 through March 1974. Visual inspection reveals four different types of seasonal waves.

Figure 1 shows variations in *new acceptors* regardless of method. We see a secular downward trend, with roughly two cycles per year. There are two peak periods, spring and fall, and two low periods, winter and summer.

Figures 2 and 3 show the movement of *total acceptors* and *total oral pill acceptors*. The totals include new acceptors plus revisits of old acceptors for resupply of oral pill cycles. Both measures show upward secular trends. This is understandable, since each new pill acceptor increases the pool of potential pill revisits, producing a cumulative accretion of acceptors. Both of these measures show one major cycle per year, starting with a low period in January and rising steadily to a high peak in December. Also in both cases, after January 1972 the peaks of the cycles are considerably dampened.

Figure 4 shows the movemnt of *IUD acceptors*. Here we have no secular upward or downward trend, though the amplitude of the wave appears to increase somewhat through the four years. There is one major cycle per year, with a peak in the spring and a low period in December. There is also a small upturn in the fall, which provides a slight resemblance to the wave for new acceptors.

Finally, Figures 5 and 6 show the waves for the two protection or *CYP* measures.(2) The wave patterns for the CYP measures resemble that for the new acceptors. Both have two cycles per year, with peaks in spring and fall, and low periods in winter and summer. They differ from the new acceptor waves, however, in that they show no secular trend. Like the IUD wave, there appears to be a slight increase in the amplitude of the CYP waves over the four years.

If we ignore the secular trends in the wave patterns, there are two major patterns in the six waves. Total acceptors and total OCP waves both show one cycle per year, with a genral movement from a deep low period in January to a high peak in December. The other four measures produce two cycles per year, with peaks in spring and fall and low periods in summer. The IUD wave varies slightly from this in that its fall peak and its summer low are considerably dampened, though they are still clearly discernible.

It would have been most useful to have data on *new* pill acceptors rather than *total* pill acceptors. This would have permitted us to compare monthly activity in recruiting new acceptors for the two major methods, IUD and OCP. Unfortunately, our original data collection obtained total pill acceptors and we did not become aware of the problem this presented until it was too late to obtain data on new pill acceptors. Thus at some points throughout the analysis, it will be necessary for us to make some inferences of how *new* pill acceptor activity varies.

If we conceive of these as measures of program output, we can also examine movements in one measure of program inputs. Figure 7 shows the movement of staff days each month. This ameasure of the number of field workers times the days of clinic service offered each month. Here we note a mild decline in values for the first year, July 1969 through August 1970, and then a steady fluctuation with no trend for the remaining period. There is considerable month-to-month variation in the measure, although the

(2) The method weights used for the CYP computations are as follows:

	Urban	Rural
First Visit		
IUD	1.580	1.970
Sterilization	12.710	12.710
OCP	.057	.070
Revisit		
IUD	3.360	3.360
OCP	.057	.057

ranges are not as large as those for the output measures. Nor does there appear to be a clear one or two cycle per year variation, as we found in the output measures. Thus, at least at first observation, the variations in overall program activity are not explained by variations in personnel inputs

3. Three Explanations for Seasonal Variation

From their intimate knowledge of the program, Korean administrators present two types of explanations for the waves. The ESCAP adminstration survey added a third. These are explanations that focus upon a) the environment, b) the contraceptive method, and c) the clinic organization, as determinants of seasonal variation.

The ***environmental*** explanation links seasonal variation to climatic and agricultural cycles. January is a very cold month. It is known that in some cases field workers have held back reports of actual acceptors in the late fall and carried over these reports into January. This gives field workers some activity to report without necessitating that they leave the warmth of the office. On the other hand, field workers may push to overfulfill targets in December to reduce expected work in January. These two types of adjustment will, of course, produce very different patterns of seasonal variation. From what we have seen in figures 1-3, the second explanation appears more plausible. Agricultural work also proceeds in definite cycles with slack work periods in December to April and peak work periods from June

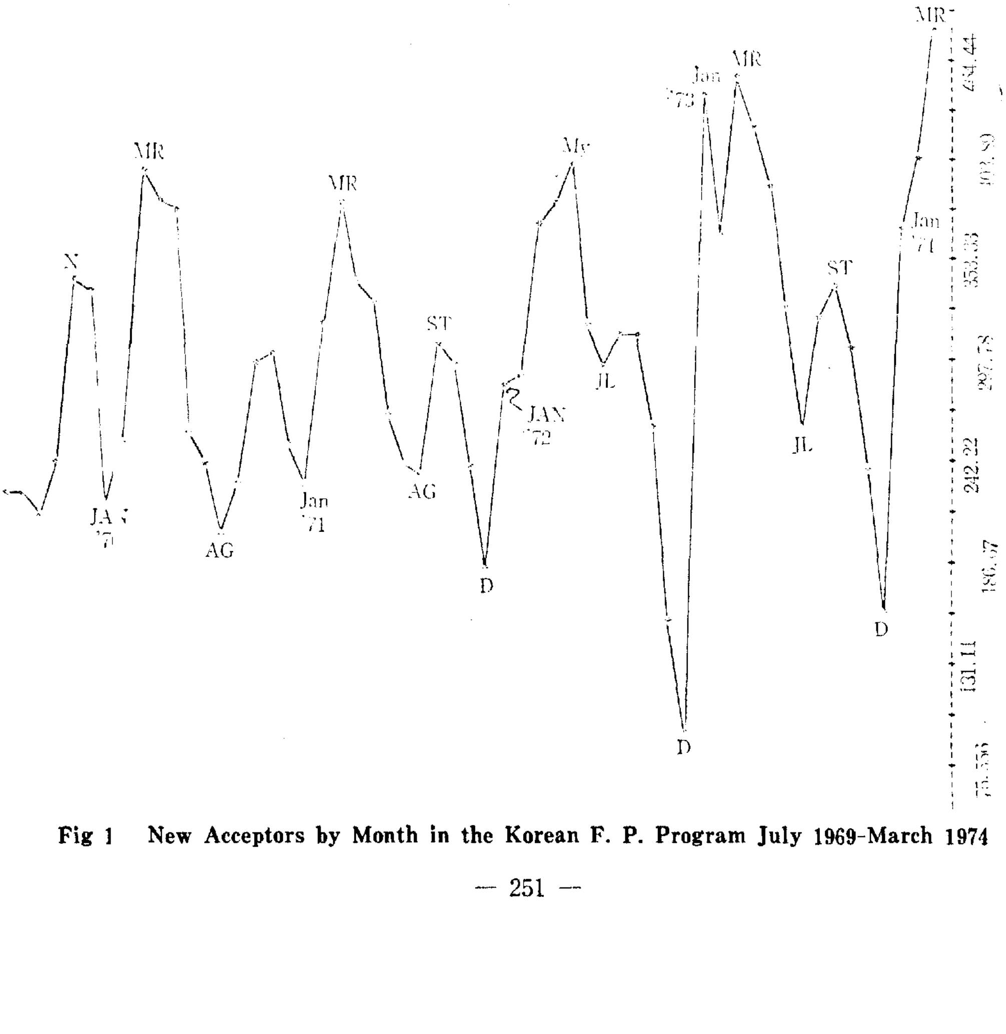

Fig 1 New Acceptors by Month in the Korean F. P. Program July 1969-March 1974

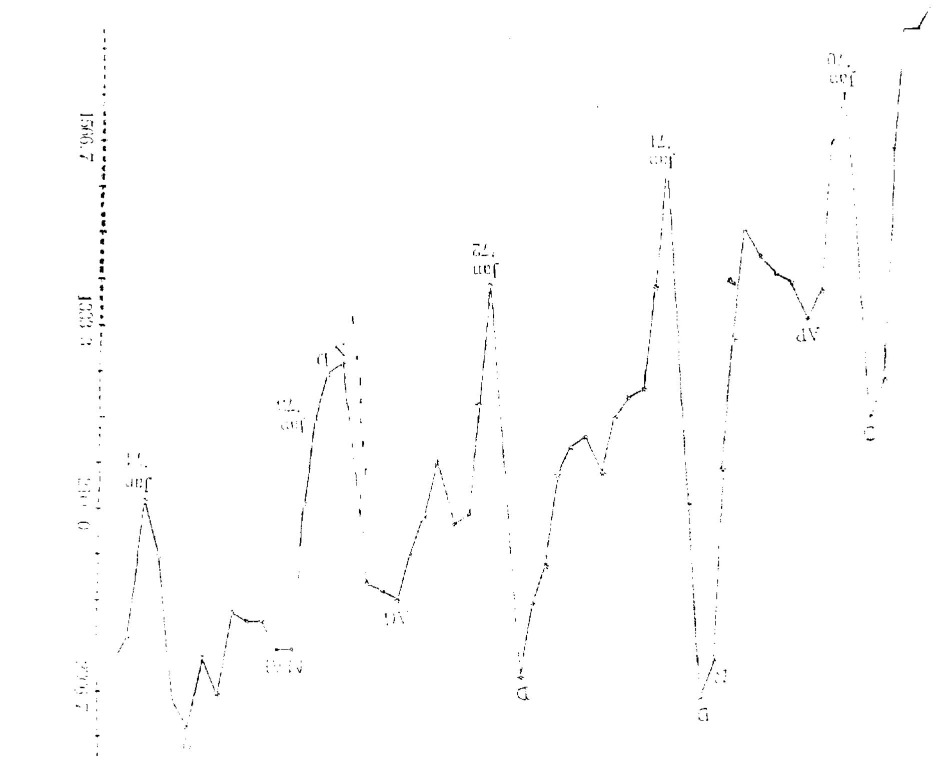

Fig 2. **Total Acceptors by Month in the Korean F. P. Program July 1969-March 1974**

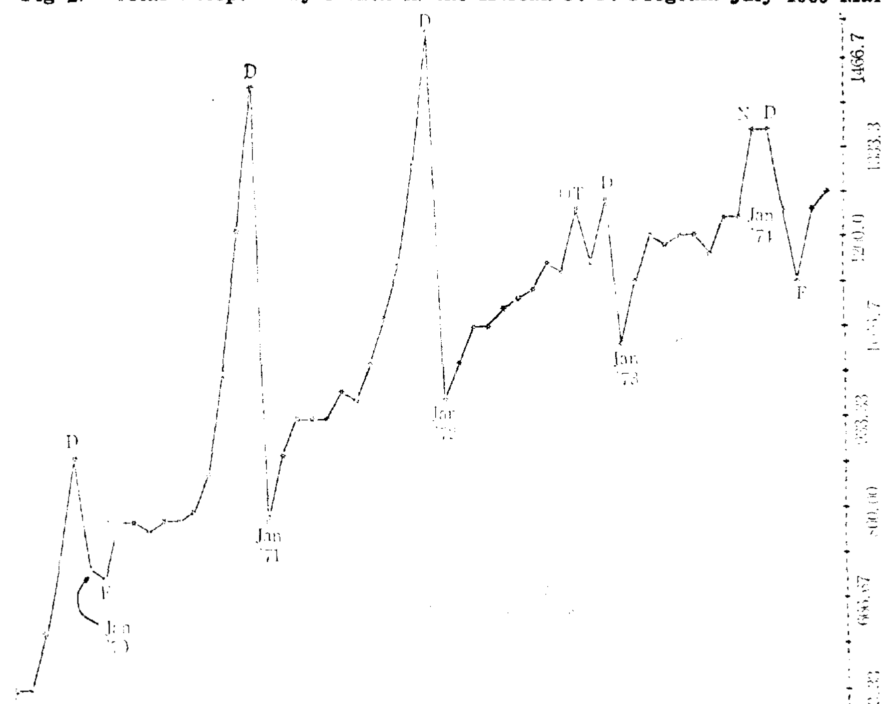

Fig 3. **Total Oral Contraceptive Pill Acceptors by Month in the Korean F. P. Program July 1969-March 1974**

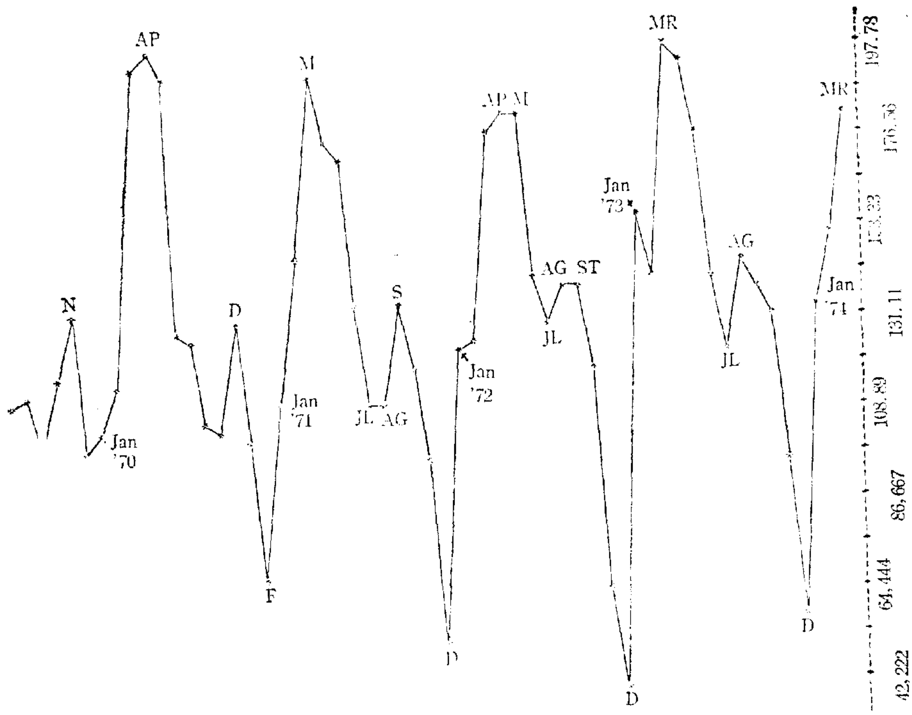

Fig 4 Total IUD Acceptors by Month in the Korean F.P. Program July 1969-March 1974

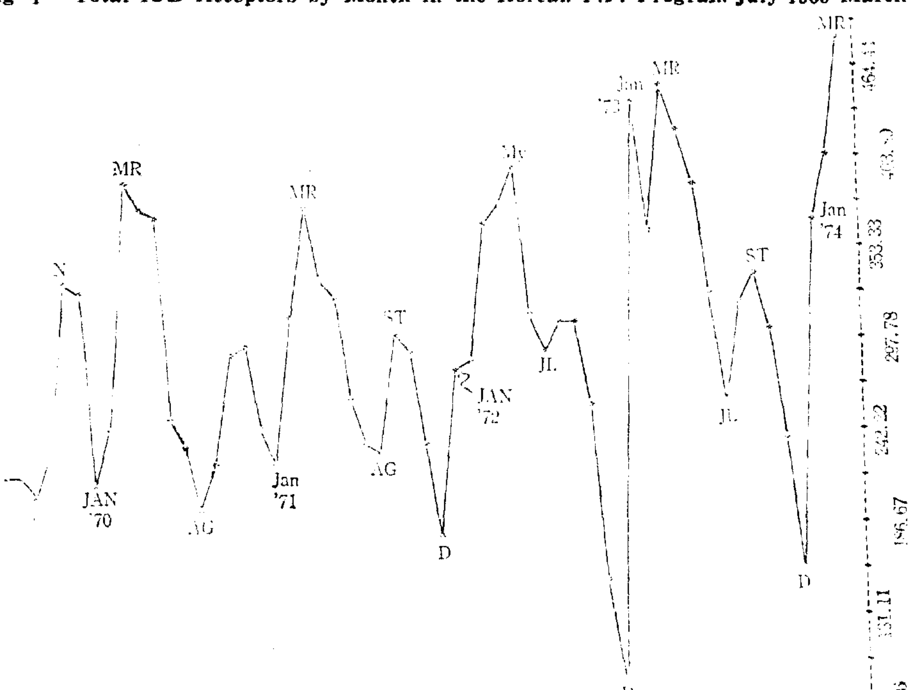

Fig 5. Couple years of Protection by New Acceptors by Month in the Korean F.P. Program July 1969-March 1974

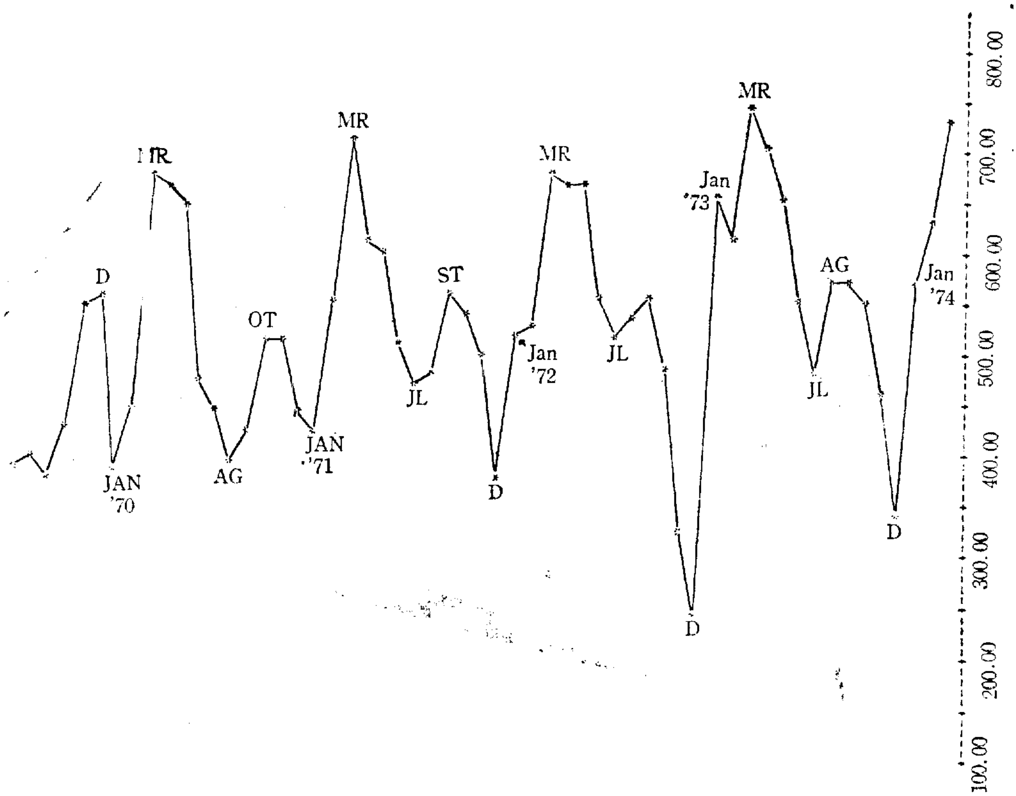

Fig 6. Couple Years of Protection from Total Acceptors by Month in the Korean F.P. Program July 1969-March 1974

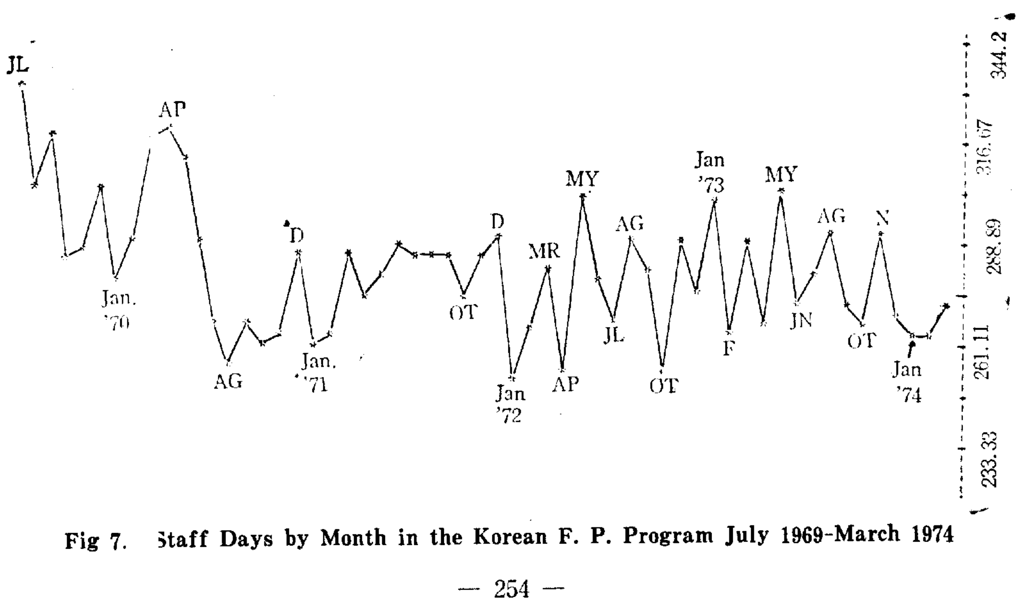

Fig 7. Staff Days by Month in the Korean F. P. Program July 1969-March 1974

through September. It is thought that this work cycle affects family planning activity by producing seasonal variation. The contraceptive *method* explanation focuses on the different requirements of methods. The pill is revenue generating; the loop is revenue consuming. IUD insertions and sterilizations are performed by private doctors "designated" by the program to perform these services and to receive a fee from government for their services. The fees are paid out of the normal program budget and thus are tied to specific program targets for those methods. If the targets are achieved, and thus funds exhausted before the end of the fiscal year, two different reactions are possible. First, services may continue to be provided, but reports will not be submitted until the beginning of the next fiscal year, when funds are once again available for the services. Alternatively, field workers may shift their recruiting efforts from IUD to OCP. That is, one strategy changes reporting only, the other strategy actually changes recruitment activity. Either strategy produces a distinct wave in reported IUD insertions and sterilizations, but only the second strategy would influence the wave pattern for pill acceptors.

The ESCAP administratration study raised the possibility that the waves represent the type of rational adjustment to environmental conditions that would be expected of an *effective organization*. There was a slight positive correlation (r=.27) between one measure of wave amplitude and a measure of clinic productivity among rural clinics. (Wave amplitude was measured as maximum minus minimum values for the year divided by the mean level of acceptors for the year; ***which we later discovered to be an invalid measure.*** Productivity was measured by numbers of acceptors per staff day of input.) This finding implies that the more efficient clinics are making some form of rational adjustment to whatever causes seasonal variation and may even be using the seasonal variation to their own advantage. For example, continuing IUD insertions "on credit," as it were, when budget restrictions delay the flow of funds, might indicate a high degree of cooperation between family planning staff and designated doctors. This is the kind of cooprration expected in an organization that makes the most effective use of environmental resources.

These explanations are all plausible, but more imporant, if they are correct in some respects, they have real and different policy implications. If environmental influences are indeed powerful, it might be useful to permit lower level administrative units to develop their own sets of targets and schedules, which could be tuned to the specific environment in which each clinic operates. If method explanations are in part correct, either more funds or targets set in terms of couple years of protection, rather than specific methods, might increase overall performance. If organizational explanations are correct and the extent of the variation is positively related to unit efficiency then administrative efforts perhaps should not be wasted on attempts to smooth out the seasonal variations. Converersely a negative relationship between efficiency and seasonal variation might indicate the need for some form of organizational improvement where seasonal variation is especially high.

In order to evaluate these explanations, we must obtain a measure of the amount of seasonal variation for each of the lower level organizational units. These are the 191 rural and urdan health centers through which the program actually reaches acceptors. We can then relate the amount of seasonal variation to characteristics of the clinic environment, the method, and the organization.

4. The Measurement of Seasonal Variation

To measure seasonal variation we essentially need a measure of the amplitude of the waves or cylces for each of the health centers. To obtain this measure we first regressed each of the output measures on time, designating July 1969 as 1, through June 1973 as 48. (we wished to have four complete years for the analysis, thus we dropped the final nine months, July 1973 through March 1974, from our analysis.) This indicates the amount of variation that could be explained by the secular trend. The remainder, or residual variation represents the amount explained by seasonal variation. Since the absolute value of this variation is affected by the absolute level of the output for each clinic, with high output clinics showing higher variation, we corrected for the difference in absolute value with a measure analogous to the coefficient of variation ($V=\frac{S.D.}{mean}$ Blalock1972 p. 88). In each case we divided the square root of the residual variation by the mean of the output measure. We call this the ***standardized measure of wave amplitude*** or ***W***. W was computed for each of the 191 health centers, and for all six of the output measures: new acceptors (NA), total acceptors (TA), IUD acceptors (IUD), pill acceptors (OCP), couple years of protection from new acceptors (NCYP), and couple years of protection from total acceptors (TCYP).

The calculation of W can be represented as follows:

$$Var\ Y\ r^2=\frac{Cov^2}{Var\ X}$$

(This equals the variance in acceptors explained by the secular trend.)

$$Var\ Y-\frac{Cov^2}{Var\ X}$$

(This equals the variance unexplained by the secular trend, or the variance explained by seasonal variation.)

$$W=\frac{\sqrt{Var\,Y-\frac{Cov^2}{Var\ X}}}{\bar{X}o}$$

where $\bar{X}_o$ is the mean of the output measure for

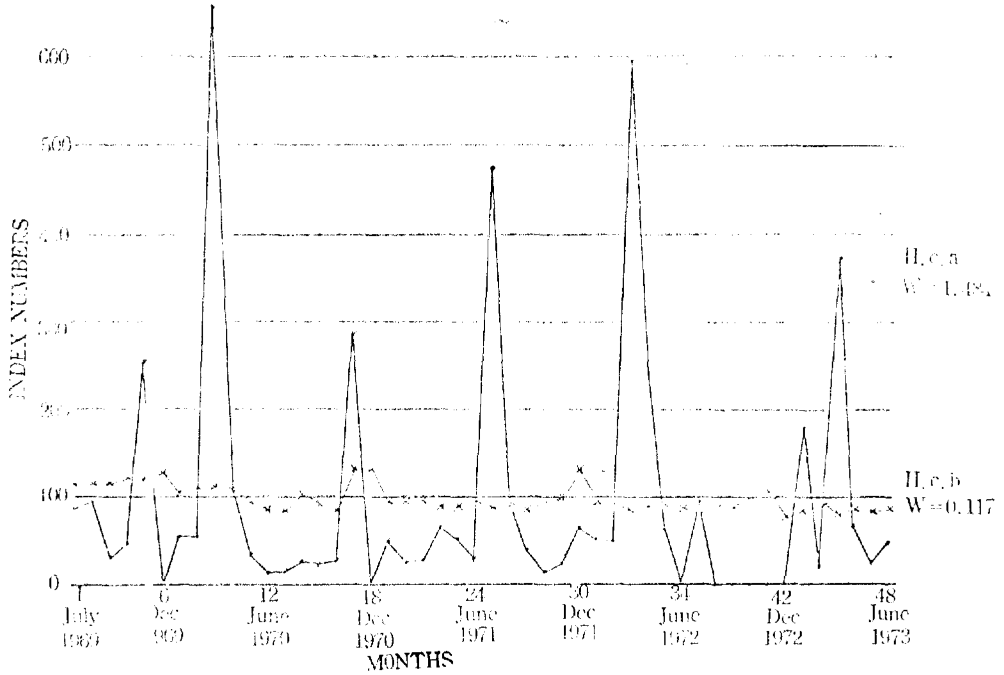

Fig 8. Monthly Variation in Numbers of Acceptors for Two Korean Health Centers

(For each Health Center index numbers are constructedusing the mean monthly acceptors as 100. The mean values are 82 IUD acceptors for Health Center *a* and 853 OCP acceptors for Heaith Cen ter *b*.)

the 48 month period.

Figure 8 provides a visual illustration of the W measure. It shows the movement of index numbers of monthly acceptors for two health centers over the four year period. The two health centers were selected to represent near extreme values of W. The "high" case shows a W value of 1.484 for seasonal variation in IUD acceptors in a rural health center. The low case shows a W value of 0.117 for seasonal variation in OCP acceptors also in a rural health center. In each case the index numbers are constructed using the mean monthly acceptors as 100. It is quite obvious from this that the W measure does discriminate seasonal variation rather sharply.

The W value gives us a single measure of seasonal variation for each of the 191 health centers, and for each of six output measures. Table 1 presents a general description of W, showing means and various measures of dispersion for each of the six W measures.

The descriptive statistics first indicate that there is sufficient variation in our measures of seasonal variation to permit a rather rich analysis. The total range in the measures is from about. 1 to over 3.0. Maximum values are at least five times the minimum values. The standard deviations range from about one-third to one-half of the values of the means, indicating substantial varion among individual health centers on all

Table 1. Means and Measures of Dispersion for Seasonal Variation, W, for all 191 Health Centers and for Output Measures for the Four Year Period July 1969—June 1973.

Output Measure	Mean	S.D.	S.E.	Coef. Var.	Min.	Max.
W NA	.579	.296	.021	.512	.210	3.167
W TA	.273	.117	.008	.426	.105	.282
W TOCP	.357	.189	.014	.528	.117	1.080
W TIUD	.620	.312	.015	.344	.266	1.484
W NCYP	.623	.180	.013	.289	.277	1.244
W TCYP	.497	.158	.011	.316	.217	1.110

NA=New Acceptors; TA=Total Acceptors
TOCP=Total Pill Acceptors; TIUD=Total IUD Acceptors
NCYP=CYP From New Acceptors; TCYP=CYP From Total Acceptors

measures. That is there is sufficient variation from health center to health center to make it reasonable for us to examine the relations between W and other characteristics of health centers.

The means also show two major categories, paralleling the two major wave patterns identified in the visual inspection. The means for total acceptors (W TA) and total OCP acceptors (W TOCP) are similar to one another and are lower than the other four means. In addition these two measure tend to show relatively more variation from health center to health center than do the IUD and CYP means. This is reflected in the greater values of the coefficient of variation $\left(\frac{S.D}{\bar{X}}\right)$ for total and total OCP than for the latter three. The new acceptors mean wave amplitude stands somewhat between these two groups in that it is relatively high, but its coefficient of variation is also relatively high.

Table 2 presents a matrix of zero-order correlation coefficients, which shows the relationship among the six measures of W. Overall, there is considerable difference in the coefficients, showing four major sets of relationships, which again reflect the two major categories, one and two cycle waves, found above. First, seasonal variations for total acceptors and total OCP acceptors are highly correlated (r=0.79). These were the two measures that on visual inspection produced waves with one cycle per year. Second, seasonal variation for the two CYP measures and for IUD acceptors are also highly correlated (r=.70 or more). These three measures produced waves with two cycles per year. Third, seasonal variation for IUD and CYP measures are unrelated to seasonal variation of total acceptors or total pill acceptors (all correlation coefficients are 0.06 or less). Finally, the variation produced by the new acceptors is weakly but significantly related to the variation of all other output measures (correlation coefficients from .25 to .45, all significant at the .01 level). We should expect this since a "new acceptor" is a component of all other measures by definition.

Table 2. Zero-Order Correlation Coefficients for Six Measures of Seasonal Variation (W) for 191 Health Centers

	W NA	W TA	W OCP	W IUD	W NCYP	W TCYP
W NA	1.00 (4)					
W TA	.25**	1.00 (1)				
W OCP	.38**	.79**	1.00 (3)			
W IUD	.36**	.05	−.04	1.00 (2)		
W NCYP	.45**	.03	.06	.79**	1.00	
W TCYP	.28**	−.00	−.02	.72**	.72**	1.00

** indicates significance at the .01 level.

(1) etc. refers to patterns discussed in the text.

These descriptions of our measures of seasonal variation clearly reflect different patterns of activity for the two major contraceptive methods used in the Korean program. Recruiting and servicing OCP acceptors is marked by relatively less seasonal variation and relatively more variation among health centers than is true for IUD recruitment. Further, the amount of seasonal variation for the pill is quite unrelated to that for the loop. Thus in the analyses that follow, although we shall normally present data for all six measures of activity, we shall focus attention on the measures for IUD and OCP activity.

5. Environmental and Method Determinants of Seasonal Variation

If environmental conditions produce seasonal variation in family planning activity, we should expect to see this reflected first in differences between rural and urban areas. Rural areas would be expected to show greater seasonal variation due to the impact of both the agricultural work cycle and the greater transportation costs associated wirh more dispersed populations.

If the contraceptive method has an impact on seasonal variation, two opposite predictions are possible, depending on whether the impact of the method works through program organization or through acceptor preference. Korean administrators note that from the perspective of the program, the IUD is revenue consuming and the OCP is revenue generating. Thus exhaustion of budgeted funds for IUD insertions before the end of the fiscal year might cause a sharp drop in IUD acceptors. Since acceptors pay a small fee for oral contraceptive pills, budget shortages would not affect acceptance. Thus if the method impact works through the program, we would predict greater seasonal variation in the IUD than in the OCP. From the perspective of the acceptors, however, month-to-month variations in available income would be expected especially among agricultural populations, and such variations might be expected to cause greater seasonal variation in OCP acceptance. Thus if the method effect works through acceptor preference, we would predict greater seasonal variation for OCP than for IUD, especially, and perhaps only, in the rural areas.

We can observe both environment and method effects on seasonal variation by noting rural-urban differences for all measures. Table 3 presents the data for this analysis.

Table 3. Mean Seasonal Variation (W) for Six Output Measures in Urban and Rural Health Centers

	All (N=191)	Urban (N=52)	Rural (N=139)	U-R Diff. Sig. Level
Output Measure				
New Acceptors				
W NA	.579	.512	.604	.056
Oral Pill				
W TA	.273	.297	.263	n.s.
W TCOP	.357	.370	.352	n.s.
IUD				
W TIUD	.620	.538	.651	.01
W NCYP	.623	.554	.649	.01
W TCYP	.497	.430	.522	.01

Both method and environment effects are clearly seen in Table 3. Seasonal variation is greater for IUD than for OCP in both urban and rural areas. Thus if cost is the reason for method differences in seasonal variation, the impact works through the program as a provider rather than

Table 4. Characteristics of Populations Served by Urban and Rural Health Centers

	All (N=191)	Urban (N=52)	Rural (N=139)
%Labor Force in Agriculture			
Mean	57.7%	10%	75%
S.D	32	11	14
Minimum	0	0	25%
Maximum	92%	45%	92%
Population Density (Pop. per sq.mi.)			
Mean*	1074	3304	241
S.D	1798	2240	154
Minimum	30	220	30
Maximum	9200	9200	1090

(* is the unweighted mean of density in urban districts and rural counties. It is somewhat higher than the average population density for all of Korea.)

through the acceptors as buyers. There is also a clear environment effect on the IUD, as seasonal variation is significantly greater in rural than in urban areas. There is no environmen impact on OCP seasonal variation.

The rural-urban distinction is, of course a gross difference that combines other more specific differences. At the very least it denotes a difference in population density and in the proportion of the labor force engaged in agriculture. These two characteristics of the populations served by urban and rural health centers are shown in Table 4. Clearly the populations served by urban health centers are more densely settled and less agrarian than are those served by the rural health centers. Nonetheless, there is considerable overlap in the measures so that we do have substantial dispersed, agricultural populations in urban health center areas and substantial densely settled non-agricultural populations in the rural health center areas. Thus if these specific environmental conditions have an impact on seasonal variation, we should be able to witness that impact in both types of health center populations.

Tables 5 and 6 show the gross relationship between seasonal variation and agriculture (Table 5), and population density (Table 6) for the various measures in both urban and rural areas. As in the gross urban-rural difference, seasonal variation in OCP activity does not appear to be affected by either of these environmental conditions.

Seasonal variation in IUD activity is affected by both of these environmental conditions, but the impact differs somewhat in rural areas. The pattern is intuitively easier to understand in the case of agriculture than in the case of population density. Agriculture work has a substantial ***positive*** impact on IUD seasonal variation, but only in the rural areas, where the variance in agricultural work is itself substantial. It is not clear from these data just how agriculture affects IUD seasonal variation, but it is not surprising that a work activity that itself runs in marked seasonal cycles should have a positive impact on family planning seasonal variation.

Population density has a rather weak positive impact on IUD seasonal variation in both urban and rural areas. Here it is less easy to construct an intuitively acceptable explanation. The environmental explanations of Korean family planning officials might actually lead to a prediction of a

Table 5. Zero-Order Correlation Coefficients Between Seasonal Variation (W) and Per Cent of the Labor Force in Agriculture for Rural and Urban Health Centers

W	Per Cent of Labor Force in Agriculture in:		
	Total (191)	Urban (52)	Rural (139)
New Acceptors			
W NA	.22**	.24	.23**
Oral Pill			
W TA	−.13	−.12	.01
W OCP	−.03	.11	−.02
IUD			
W IUD	.28**	−.06	.23**
W NCYP	.30**	.37**	.37*
W TCYP	.27**	.14	.09

* indicates significance at the .05 level
** indicates significance at the .01 level

Table 6. Zero-Order Correlation Coefficients Between Seasonal Variation (W) and Population Density for Urban and Rural Health Centers

	Population Density in:		
	All (N=191)	Urban (N=52)	Rural (N=139)
New Acceptors			
W NA	−.16*	−.19	−.02
Oral Pill			
W TA	+.14	+.12	−.02
W TOCP	+.03	−.02	+.03
IUD			
W TIUD	−.10	+.23	+.20*
W NCYP	−.20**	−.10	+.15
W TCYP	−.15	+.10	+.21*

* indicates significance at the .05 level
** indicates significance at the .01 level

negative relationship, although the logical connections are rather tenuous. For example, officials guess that workers, and perhaps clients, are more reluctant to move about in the cold winter months, which would produce deep troughs in activity in January. We might expect this impact to be more powerful in areas of lower density, where travel distances between clinic, worker and client would be expected to be greater. By this reasoning, population density should be negatively rather than positively associated with IUD seasonal variation. For the moment we shall have to leave this relationship without a satisfactory explanation and hope that later we may be able to suggest something more than simply that this is a question that requires more research.

At this point we appear to have two types of effects on seasonal variation: program effects and acceptor effects. The differnce in seasonal variation of the two methods appears to work at least in part through the character of the program as an organized activity. The environment effects, on the other hand, appear to operate through the acceptors. The program, possibly through budgetary constraints, produces high seasonal variation in IUD acceptors. The agricultural work cycle also produces high seasonal variation in IUD acceptance. This suggests a process in which movement of both program personnel and acceptors combine to produce seasonal variation. The IUD requires movement between three points: health center staff to clients, or clients to health center, and clients (and possibly center personnel as well) to designated doctors for IUD insertion. When budgetary resources permit, center personnel move to recruit IUD acceptors. When the agricultural work cycle permits, acceptors move to doctors for IUD insertion. The OCP requires movement between only two points: acceptor and health center. Center personnel can visit and supply acceptors, or acceptors can visit the health center for supplies. Budgetary constraints will not affect acceptor movement, and the agricultural work cycle will not affect movement of health center personnel. This model does not help us to explain the impact of population density on seasonal variation, but it does lead us on to a consideration of the logically connected role of the organizational characteristics of the individual health centers. We can posit two ways in which these organizational characteristics work.

Movement of health center personnel can be considered a form of human resource mobilization that is in part detemined by the character of the organization of those human resources. More effectively organized health centers will provide better supervision and higher levels of personnel motivation, resulting in more physical movement and better acceptor recruitment. In addition, however, better organized health centers will be sensitive to such critical environmental conditions ash the agricultural work cycle. They will adapt to tat fixed environmental condition more effectively, producing a pattern of personnel movement attuned to the agricultural cycle. In the same way, budgetary constraints will be a part of the environment of the individual health center. Although this is a part of the organizational environment rather than part of the external physical and economic environment, it may be considered just as fixed as is the physical environment, thus requiring the same qua of organizational adaptation. Thus through determining both the amount and the quality or direction of personnel movement, the organizational character of the individual health center will have an impact on the amount of seasonal variation experienced. To test the propositions of this model we must move to a consideration of organizational performance.

6. Organizational Determinants of Seasonal Variation

To assess organizational performance, we shall draw upon the ESCAP study of family planning administration (Kim 1974). For organizational performance that study used a simple ratio of outputs to inputs, basically acceptors per staff day, which is denoted ***productivity***. Productivity was measured for the entire program over time and for each of the individual health centers that form the front-line organizational units of the program. Since the numerator of the productivity ratio, acceptors, can be counted in the same six ways we used to measure output, six different productivity ratios are available.[3] In both one year, 1972-3, ESCAP data and in our own four year data series, all productivity ratios are found to be highly correlated with one another. The single most comprehensive ratio is couple years of protection from all acceptors, divided by staff days (TCYP/SD). This ratio was correlated about +0.90 with all other ratios. Thus we shall use this single ratio as our measure of health center ***productivity***.

The ESCAP study found productivity to be related to both environmental and organizational characteristics. Productivity is higher in urban than in rural areas and is positively correlated with population density and negatively correlated with the per cent of the labor force in agriculture in the area served by the health center. The organizational correlates of productivity included good logistics (low staff reports of shortages or delays insupplies and payments), staff perceptions of contact and support with other agencies, and positive staff attitudes towards the program, the work, and the clients served.

One of the striking fiindings of the ESCAP study was of the different organizational determinants of productivity in urban and rural areas. In urban areas productivity was higher where there was a larger number of the less trained

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(3) The different productvity ratios might be seen to reflect different types of efficiency. Thus TA/SD might reflect efficiency in ***recruiting*** new acceptors; TA/SD might reflect efficiency in both recruiting and holding acceptors; TCYP/SD might reflect efficiency in meeting long term goals of protection rather than short term goals of recruiting acceptors. Since all measures are highly intercorrelated, howeve, it appears that there is little difference between these types of efficiency.

and qualified staff (health assistants) who were younger, with no children and not necessarily well acquainted with the people in the area served by the health center. Further, when family planning staff reported giving time away to other agencies, as they were often asked to do by local civil administrators, productivity was lower. In the rural areas productivity was higher when staff were somewhat older, more experienced, and were themselves practicing family planning. Further, when staff reported giving away time to other agencies, productivity was *higher*. These differences were interpreted as reflecting the different organizatioal demands of the specific socioeconomic environments: the densely settled, more differentiated and less personally organized market society of the urban areas versus the more sparsely settled, less differentiated and more personally organized society of the rural areas.

Overall, then, the ESCAP study established the productivity ratio as a useful and defensible measure of organizatioal performance, which we can thus use here with some confidence. Our attempt to examine the relation between seasonal variation and health center performance confronts problem, however, for which we have no really satisfactory solution. To assess seasonal variation accurately we need a long period of time. The four years of data available for this study probably represent something near the minimum period needed for an accurate assessment of seasonal variation. On the other hand, organizational characteristics may very well change from year to year. Supervisors and staff in health centers and in the other units with which the family planning program staff interact may change from year to year, and this may have an impact on organizational performance. By averaging output and input data over a four year period, it is possible that we eliminate a good part of this internal variation and leave only the effects of the more stable environmental characteristics. Our only solution at this time is to examine the relationships we have with the four year data set and then to interpret the findings in the light of the more precise indications of organizational performance found in the shorter data set.

Tables 7 and 8 show the gross environmental impact on productivity for our four years of data. As in the ESCAP study, urban productivity is higher than rural productivity, and productivity is positively related to population density and negatively related to per cent of the labor force in agriculture. That is, the urban-industrial environment may be said to produce higher productivity. It is plausible to see the urban-industrial environment as one in which the costs of providing family planning services are lower than in the rural-agrarian environmet. Higher population densities reduce transportation costs for both staff and acceptors, and the urban environment, with its typically more modern fertility norms, reduces the costs of persuading persons to accept contraceptive practice. The mechanisms here are the same in rural and urban areas and in the overall system as well. These environmental effects do not explain all the variance in productiv-

Table 7. Means and Standard Deviations of Productivity (TCYP/SD) in All. Urban and Rural Health Centers

	All (N=191)	Urban (N=52)	Rural (N=139)
Mean	1.93	2.73	1.13
S.D.	0.77	1.01	0.34

Table 8. Zero-Order Correlation Coefficients Between Productivity, Per Cent Agriculture and Population Density in All Urban and Rural Health Centers

Productivity and	All (=191)	Urban (N=52)	Rural (N=139)
% Ag	−0.68**	−..58**	=0.21*
Population Density	0.67**	0.42**	0.29**

*indicates significance at the 5% level
**indicates significance at the 1% level

ity, however, leaving room for the organizational characteristic found in the ESCAP study to have an impact on productivity as well.

For a first approximation of the impact of organizational performance on seasonal variation we can examine the correlation between productivity and the various measures of seasonal variation presented earlier. Negative relationships would support the hypothesis that seasonal variation represents an organizational problem, or some form of operational weakness. They would also support hypothesis that staff movement is an important determinant of seasonal variation. Positive relationships, on the other hand, would support the hypothesis that seasonal variation is the result of a rational adjustment to the environment, more effectively achieved by the more effective local organizations.

Table 9 shows the zero order correlations between productivity and the various measure of seasonal variation, for all, urban and rural health centers. What stands out immediately is the important differences among the correlations by both method and environmental characteristics. First, new acceptor seasonal variation is negatively related to productivity, but only in urban areas. Second, OCP seasonal variation is positively related to productivity but only in rural areas. Finally, IUD seasonal variation is negatively related to productivity in both urban and rural areas, though the relationship is relatively weaker in the urban areas. Obviously the impact of organizational performance on seasonal variation is even more complex than the impact of environmental conditions.

Table 9. Zero-Order Correlation Coefficients Between Productivity (TCYP/SD) and Six Measures of Seasonal Variation

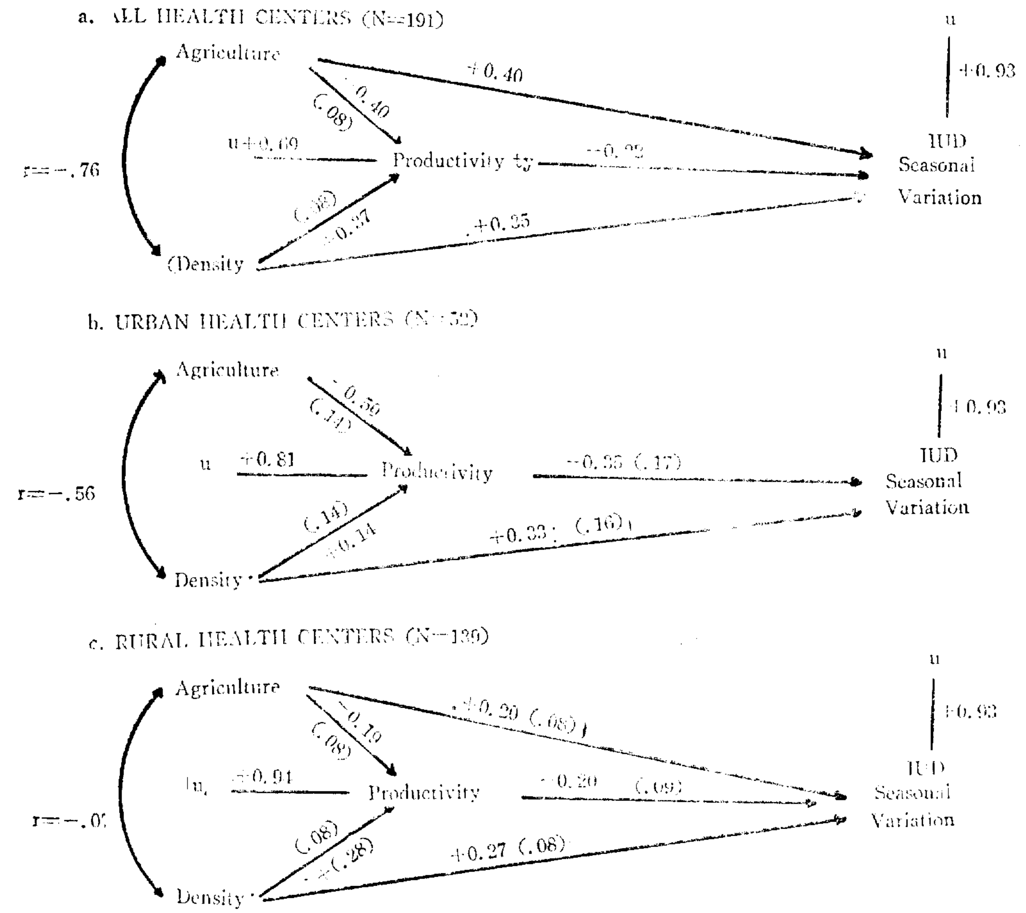
W	All (N=191)	Urban (N=52)	Rural (N=139)
W NA	−.18**	−.42**	+.08
W TA	+.14*	+.03	+.16*
W TOCP	+.06	−.11	+.21*
W IUD	−.25**	−.17	−.17*
W NCYP	−.31**	−.29**	−.18*
W TCYP	−.29**	−.13	+.02

* indicates significance at the 5% level
** indicates significance at the 1% level

7. A Model of Seasonal Variation

Our environmental and organizational variables can be put together in a causal model that attempts to explain seasonal variation. The model has the advantage of stating clearly our conception of the determinants of seasonal variation, the relative impact of the various determinants and the variations in the patterns of determination for urban and rural areas and for various contraceptive methods. Further, since we have seen that both environmental and organizational conditions affect seasonal variation and that these conditions are themselves interrelated with one another, it will be most useful to attempt to assess the ***independend*** effects of each of the hypothesized causal variables. The multiple linear-regression model used here permits us to examine these independent effects. Thus for example, the model will help us to determine whether the organizational conditions have an impact on seasonal variation independent of the environmental conditions. Hopefully the model and its estimates will help us to evaluate the current explanations of seasonal variation that have different policy implications.

Since we have seen that seasonal variation differs considerably for the two major contraceptive methods, and that IUD seasonal variation is greater in magnitude and is consistently related to environmental and organizational characteristics, we begin with a model of seasonal variation in IUD activity. The path diagrams in Figures 9 A,B, and C represent this basic model. The paths lead from independent variables with arrows porting to the dependent variable. The path coefficients show the direction of the impact, negative or positive, and since they are standardized regression coefficients, they can be used to compare relative impacts of the independent variables on the dependent variable within each model. The arrows from variables *U* to the dependent variables show the amount of variance in the dependent variable that is unexplained by the varia-



Standard errors of the path coefficients are shown in parentheses. Paths are omitted when the coefficient is less than the standard error in absolute terms.

Fig 9. Path Diagrams Representig a Model of Environmental and Organizational Determinants of Seasonal Variation, IUD

tion in the independent variables. Finally, by convention the curved double arrows at the leftside of the diagrams simply show the correlation between these two variables, which for this model is taken as given and is unexplained. We follow Duncan et. al. (1967, 1972) in considering significant those coefficients that are greater than their standard errors. For those who prefer different criteria, we present the standard errors in parentheses with each of the coefficients.

Figure 9 A is a path diagram for all health centers. Here the model states that the two environmental variables and productivity all have direct and independent effects on IUD seasonal variation. Both agriculture (+.40) and density (+.35) have positive and roughly equal independent effects on seasonal variation. Productivity has a weaker and negative direct effect. Further, both environmental variables also have additional indirect effects on seasonal variation through their effects on productivity. What is important to note is that although productivity is determined in part by the environmental variables, it also has an independent and direct impact on seasonal variation. For IUD seasonal variation that impact is negative. That is, the more productive health centers have less seasonal variation in IUD activity than do the less productive ones. Thus at least for IUD activity, seasonal variation can be seen in part as a problem of organizational weakness.

When urban and rural health centters are considered separately the negative impact of productivity remains intact. The direct effect of both environmental variabls retain significance in the rural health centers, but in the urban health centers agriculture loses its direct effect. (The path is omitted when its coefficient is less than its standard error.) Thus for the urban health centers, agriculture has only an indirect effect on seasonal variation through its negative impact on productivity.

To assess the relative weight of the independent variables across urban and rural models, we can use the (non-standardized) partial regression coefficients shown in Table 10. Agriculture has a more powerful negative impact on ***productivity*** in urban than in rural areas (−.445 to −.005), while density has a more powerful positive impact in rural than in urban areas (.061 to .066).

The difference in the weights of the impact on ***seasonal variation*** are somewhat more important, however. Coefficients for all three (% Ag., density and productivity) are larger for the rural than for the urban areas. Thus both environmental and organizational conditions are considerably more important in determining seasonal variation in the rural than in the urban areas. The rural health centers are more vulnerable than the urban health centers to these sets of determining conditions. It is especially important to see this pattern with respect to productivity. Everywhere, weaker, less productive health centers experience greater seasonal variation. And, in the rural areas, where the environmental conditions have a stronger impact, organizational weakness is especially important in producing seasonal variation. Thus seasonal variation appears to reflect a problem of organizational weakness, which is especially acute in the rural health centers.

The ESCAP study found that staffing, especially of the higher quality, better trained personnel, was weaker in the rural than in the urban health centers, and that this staffing weakness was apparently related to lower levels of productivity. It also appeared in that study that the weak rural staffing patterns affected productivity in part through producing less effective relations between the family planning team and other technical and administrative offices. It is possible that the same weak staffing patterns also results in less efficient allocation of organizational resources, and less effective adaptation to both the natural and the organizational environment,

Table 10. Partial Regression Coefficients(with their standard errors) in Multiple Regressions of Productivity and Three Measures Seasonal Variation.

Independent Variables	Dependent Variables			
	Productivity TCYP/SD	Seasonal Variation		
		WIUD	WOCP	WNA
All Health Centers				
% Agric.	−.010*	+.003*	−.000	+.002*
(S.E.)	(.002)	(.001)	(.007)	(.001)
Pop. Density	+.016*	+.003*	−.000	+.001
(S.E.)	(.003)	(.001)	(.001)	(.002)
Productivity	—	−.060*	+.018	−.029
		(.030)	(.030)	(.040)
Constant	2.304	.536	.325	.511
r^2	0.52	.13	.004	.05
Urban Health Centers				
% Agric.	−.445*	−.001	+.002	−.000
(S.E)	(.010)	(.003)	(.003)	(.004)
Pop. Density	+.006	+.003*	+.000	−.000
(S.E.)	(.006)	(.002)	(.001)	(.002)
Productivity	—	−.064*	−.014	−.102*
(S.E.)		(.030)	(.030)	(.040)
Constant	2.971	.633	.374	.801
r^2	0.35	.14	.018	.18
Rural Health Centers				
% Agric.	−.005*	+.003*	+.000	+.006*
(S.E.)	(.002)	(.001)	(.001)	(.002)
Pop. Density	+.061*	+.039*	−.004	+.000
(S.E.)	(.020)	(.010)	(.010)	(.020)
Productivity	—	−.129*	+.127*	+.124*
(S.E.)		(.050)	(.050)	(.080)
Constant	1.83	.534	.125	.027
r^2	0.12	.14	.07	.04

The standard errors for the coefficients are shown in parentheses below each coefficient. We consider a coefficient significant if it is greater than its standard error. Such coefficients are marked with an * for ease of identification. Note that in most of these cases, the coefficient is two or more times its standard error.

which in turn produces higher levels of seasonal variation.

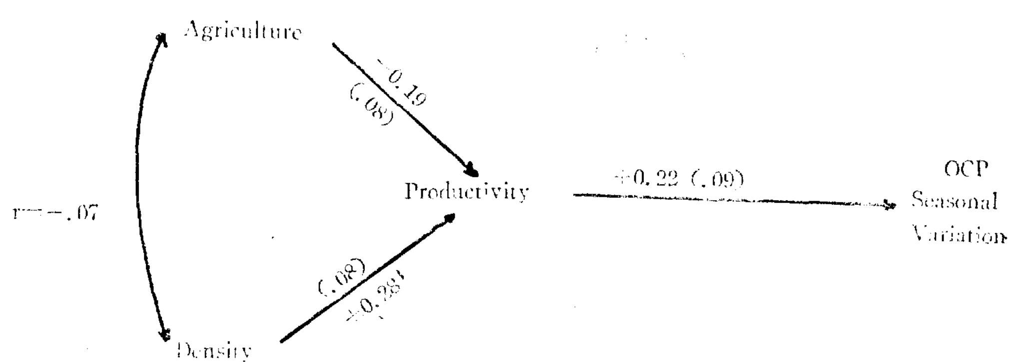
The positive impact of agriculture on seasonal variation is also relatively easy to explain in the same terms used above. Since agricultural work proceeds in a seasonal cycle, it should have a positive impact on seasonal variation in family planning activity. We shall be able to test this hypothesis further when we consider the timing of peak family planning activity.

Population density presents a much greater enigma. That density has an independent *positive* impact on seasonal variation runs counter to the expectations derived from the observation that seasonal variation is greater in rural than in urban areas, although it is consistent with the urban and rural correlation coefficients we saw earlier. It is clear, however, that population density has a clear and consistent positive impact on seasonal variation, and that this presents a set of questions that should also be the topic of future research.

The basic model works in significantly altered fashion for seasonal variation in OCP activity (Figure 10). It does not work at all in urban areas, (where all cofficients are less than their standard errors and in rural areas the environmental variables only work indirectly through health center productivity. Further, in this case productivity has a ***positive*** rather than a negative impact on seasonal variation. The partial coefficients in Table 10 show that productivity has roughly the same magnitude of impact on OCP as on IUD variation, though the direction of the impact is the opposite, +.127 for OCP and −.129 for IUD. It appears that in the rural areas where there is a substantial environmental effect on IUD seasonal variation, the more productive health centers both reduce the amount of IUD variation and also possibly shift efforts more heavily to OCP recruitment in the low IUD periods. Thus the oral contraceptive pill appears to be a method used by the more effective health centers to adapt to environmental conditions by an internal shift of organizational resources.

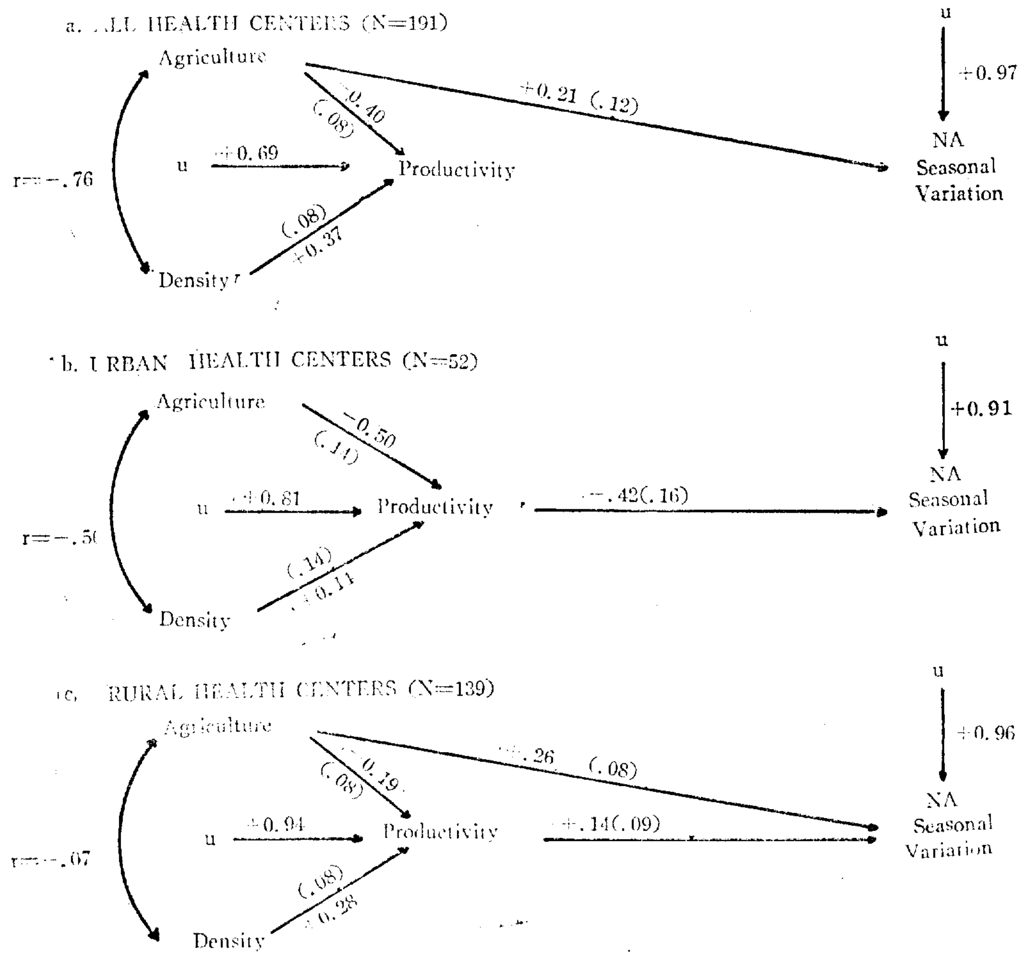
Finally the model also works in abbreviated fashion to explain seasonal variation in new acceptors (Figure 11). New acceptors are made up basically of IUD and OCP acceptors, but we have already noted a deficiency in our data for analyzing the method components of the new acceptors. IUD acceptors are primarily new acceptors, but OCP acceptors include both new acceptors and clients returning for resupply of pills. For all health centers only agriculture has a direct, positive, impact on seasonal variation in new acceptors.But it is the difference between urban and rural areas here that is most interesting. In urban areas productivity has a direct and ***negative*** impact; in rural areas both agriculture and productivity have direct and ***Positive*** impacts on seasonal variation. It seems likely that despite the deficiency in the OCP measure, the pattern for new acceptors does reflect the

RURAL HEALTH CENTERS (N=139)



Standard Errors of the Path Coefficients are shown in parentheses. Paths are ommitted when the coefficients are less than their standard errors in absolute terms. For all health centers and urban health centers, all coefficients are less than their stanard errors, thus those models are ommitted from this presentation.

Figure 10 Path Diagram Representing a Model of Environmental and Organizational Determinants of Seasonal Variation, OCP



Standard Errors of the Path Coefficients are shown in parentheses. Paths are ommitted when the coefficient is less than the standard error in absolute terms.

Fig 11. Path Diagrams Representing a Model of Environmental and Organizational Determinants of Seasonal Variation, NA

combined impact of OCP and IUD acceptor seasonal variation, with the important rural-urban differences noted above. That is, in the urban areas the pattern for OCP seasonal variation is probably not substantially different from that for IUD variation, except with respect to environmental determinants. The environmental effects are less powerful than the organizational effects, and the latter are consistently negative for all forms of activity. The more productive health centers show less seasonal variation. This again makes seasonal variation appear to reflect some weakness in the allocation of organizational resources. In the rural areas, on the other hand, the positive impact of productivity on new accepter seasonal variation continues to support the hypothesis that the OCP is a method used by the more productive health centers to balance the heavy environmental impact on IUD variation.

To this point our analysis has focused on the *amount* of seasonal variation. Agrarian conditions and weak organizational characteristics appear to result in higher levels of seasonal variation. The ESCAP study has given us some indication of how organizational weakness results in higher levels of seasonal variation. To examine how the agrarian condition results in higher levels of seasonal variation, we shall have to examine the timing of that variation.

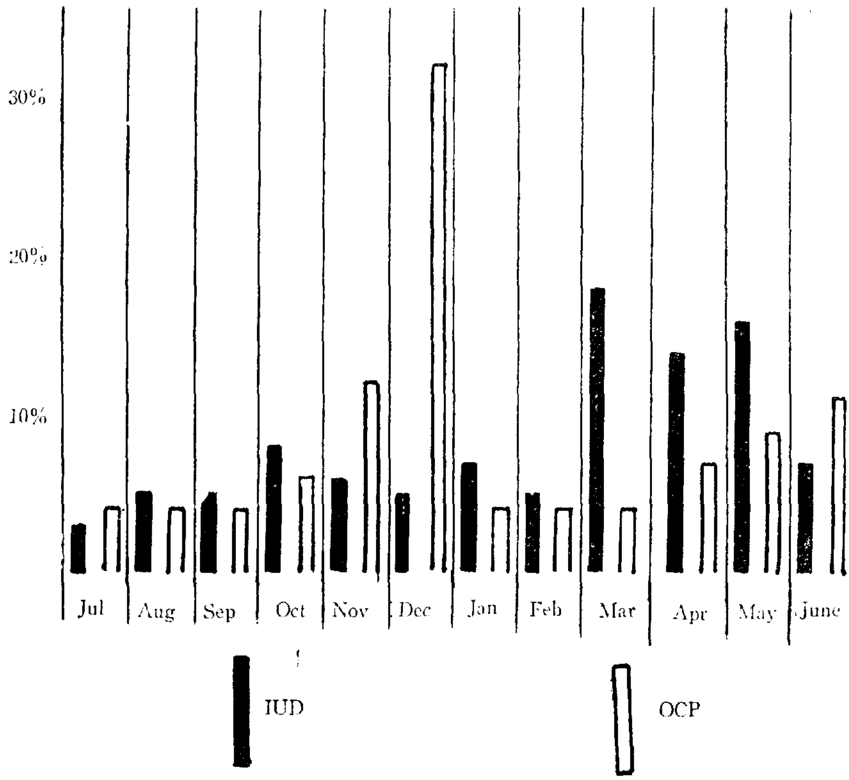
8. The Scheduling of Peak Periods.

One way to examine the timing of seasonal variation is to consider the peak periods, identified by the month in which health centers experience their maximum number of acceptor for each year. We first identify for each year the month in which each health center had its maximum number of acceptors then calculate the per cent of all health centers that show maximum acceptors, or maximum activity, in each month. If there were only random variation in activity, on the average, each month might be expected to show about 8% of all health centers with maximum activity. We might be more precise and argue that since inputs are positively related to outputs and since inputs should be larger in longer months than in shorter months, only the months with 31 days should be expected to show maximum activity. This gives us only seven months (January, March, May, July, August, October and December), so that on the average we should expect each of these seven months to have about 14% of the health centers showing maximum activity, if there were only random monthly variation.

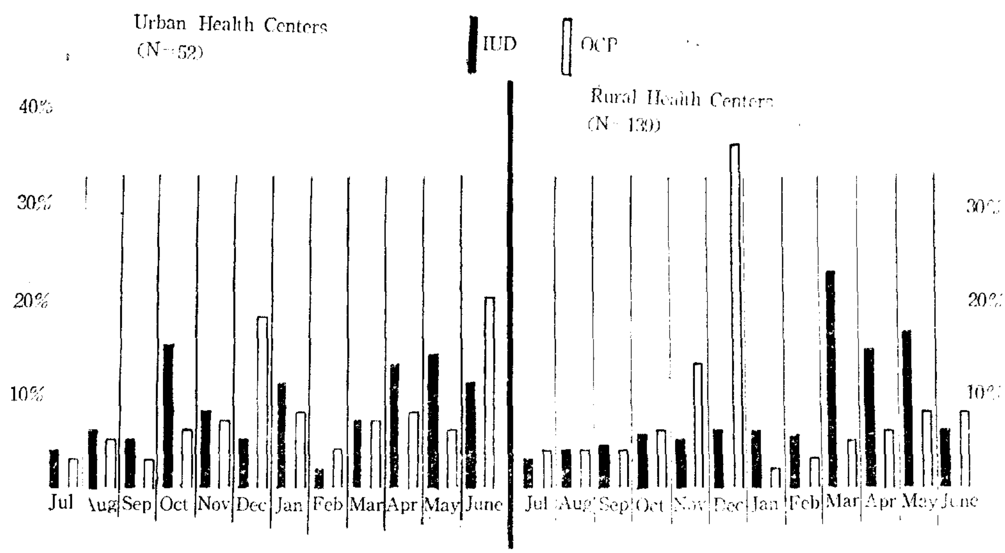
Graphs 12 and 13 show the proportion of all health centers showing maximum OCP and IUD activity each month, for the four year period of our observations. As we should expect, there are definite peak periods, that represent some form of seasonal variation. The peak periods we find here correspond with the peaks we observed in the initial visual examination of acceptors. Consider first Figure 12, showing data for all 191 health centers taken together. There is a large clustering (32%) of health centers with their maximum OCP activity in December. Two other much smaller clusters are found in November and June, each with 12% of the health centers showing maximum activity. For IUD activity March, April and May stand together as a period in which almost half of the health centers (18%+14%+16%=48%) experience their maximum activity.

The overall pattern obscures important differences between peak periods in rural and urban areas (Figure 13). Not only is there less seasonal variation in the urban areas in absolute terms, as we saw earlier, there is also less clustering of peak periods in any month throughout the year. There are two periods, December and June, when we find a mild clustering (18% and 20%) of health centers with maximum OCP activity. There is even less pronounced clustering of maximum health center activity for the IUD with only mild indication of a fall (October) and peak. (April, May)

The rural health centers have shown higher levels of seasonal variation and here we see very pronounced periods of peak actity. A single month, December, finds a third (36%) of the health centers experiencing their maximum OCP activity. No other month even begins to approach December for the clustering of peak activity. For IUD activity there is a similar pronounced single peak period, but it continues over three months, March-April-May, rather than being concentrated in a single month. In this spring peak period, March is the favored month, with about a quarter of all health centers experiencing maximum activity. April and May are considerably behind March,



Fi : 12. Per Cent of All Health Centers Showing Maximum IUD and OCP Activity by Month, July 1969-June 1973.



F g 13. Per Cent of Urban and Rural Health Centers Showing Maximum IUD and OCP Activity by Month, July 1969-June 1973

but they are also considerably above the other months. Together the three spring months find half of all health centers experiencing maximum activity.

We can gain some understanding of the determinants of these peak periods by examination of both climatic and economic factors that are especially relevant to the rural areas.[4] The December peak for the OCP activity is not easy to explain at this time, December is a cold and dark month, with temperatures and hours of sunshine at the minimum level for the year. Labor inputs for farm households are also at or near their minima, but so is farm income, both from and non-farm sources. It is not easy to link any of these factors, other than low labor requirements, to the peak of OCP activity. That is, these environmental factors, which would tend to reduce the movement of acceptors, are not readily relatable to the great December peak. It is possible, then, that factors affecting the health center or its staff are more powerful. Popular explanations among Korean administrators appear more plausible at this time; they include misreporting, or concentrated activity in December to meet targets so that work will not be demanding in January, which is both the coldest and the most festival-filled month. Again, however, we should remember that we cannot be very precise with the OCP data in any event, since they include both new and continuing acceptors.

Climatic conditions and farm labor and income data provide a more intuitively satisfactory explanation for the spring IUD peak, especially if we consider their impact on the *movement* of both program personnel and acceptors. March is the month of greatest activity. Over a four year period about one quarter of all health centers experienced their maximum monthly IUD activity in March. For each of the four years March had the largest proportion of health centers experiencing maximum IUD activity. Climatic conditions in March encourage movement of both program personnel and farmers. Temeratures are rising sharply in March, with means about half way between the minimum and maximum levels for the year. Mean levels of precipitation are low and the month ranks third in the mean hours of sunshine. Climatically this is a pleasant time to be out and about. It is perhaps doubly pleasant and conducive to movement because it comes hard on the heels of two or three months of rather inclement weather.

Climatic conditions encourage movement of both program and farm personnel. Farm economic condition also specifically encourage movement of farm personnel. In march farm labor requirements are rising from the lowest levels of the deep winter months, but they are not near the peak months of the summer and fall. The average of 68 hours for males and 40 hours for females is twice that for December but far below the respective levels of 130+ and 75+bours required in the peak labor periods of June and September.

Farm income variations may also have a positive impact on movement during March. Farm household expenditures do not vary substantially from month to month, but farm income does. Peak income, which is from rice, comes in November and January, though there are substantial levels of rice income throughout the year. Rice is the largest single source of farm household income, typically accounting for about 40% of total income, or about 48% of total income directly from farm products. Cash incomes from special crops and potatoes, as well as non-farm income from wages tend to rise sharply in March over lower levels in February. It is quite possible that the income from rice, the major source of income, is defined as income for regular ongoing

(4) Economic Planning Board, Republic of Korea, ***Korea Statistical Yearbook***, 1974. Climatic data are found in Tables 6 and 8, farm labor data in Table 64 and farm income data in Table 67.

farm costs. Income from other sources, however, can easily be seen as extra or windfall incomes, for which regular expenditures are not so definitely defined. Such income can more readily be used for visits to town, for light consumer expenditures and for entertainment.

March is indeed a month that encourages movement It is the first pleasant, warm and sunny month after the dull cold winter. It is a month without excessive labor requirements for farm families and with a bit of extra cash income. It is a pleasant month for movement of program personnel and it is an especially pleasant month for farm families to be out and about. We have already argued that cost factors do not directly affect acceptors of IUD's, thus the additional income for farm families does not directly increase the capacity to purchase contraceptives. It does, however, increase the movement of farm families, and this additonal movement increases IUD acceptance.

At this time it is impossible to test more precisely the impact of these climatic and economic effects, since the data available are not collected on units that correspond to the areas served by the health centers. The data are from national averages in the case of farm household income, or from averages of the twenty-five climatological stations spread throughout the country. Further, it is not possible to separate the effect of climate from that of farm household economics. It would be important to do this, since the two effects probably imply a difference in where and how the impact works. Pleasant weather may have its most important effect through inducing family planning workers to move about more aggressively for recruitment. Thus we should expect to achieve greater levels of actual contact and recruitment for the same abosolute amount of staff time. On the other hand, farm household labor and income changes probably indicate an impact on acceptors or potential acceptors. Thus it is possible to hypothesize that climate is an especially important ***program*** impact variable while farm economics is an important acceptor impact variable. The policy implications of knowing which is the more important determinant are considerable. At this time, we can provide no answers, but it is perhaps not inconsequential that we can sharpen the questions to be asked.

9. Changing Levels and Schedules of Seasonal Variation.

Korean family planning administrators have made many changes in the workings of the program over its lifetime. Quite typically, such changes are made when a series of problems emerge in the normal course of administrative leadership and suggest that some of change in procedures could usefully deal with that problem. Seasonal variation has not itself been perceived as a major problem, but some of its component related elements have been so perceived, such as financial shortages or problems in paying for IUD insertions, or perceptions of inaccurate reporting at the health center level. Some of the changes made by administrators have been designed to reduce these components of seasonal variation, others might be expected to have an impact on seasonal variation incidental to other aims. It is useful, then to consider to what extent and in what directions the amount of seasonal variation has changed over time.

We have available at least two ways to consider changes over time in seasonal variation. First we can examine mean levels of seasonal variation for smaller units of the four-year time period for which data are available. In addition, since we have identified distinct peak periods for some types of activity, we can ask whether there has been a change in those peaks over the four years, either in the month of the peak or in the clustering of health centers around that peak.

Neither analysis can be considered very precise, since the observations become smaller in number and the error margins more important. Further, the frequency and timing of the administrative changes preclude accurate assessments of their independent impact of the changes on seasonal variation. Nonetheless, this type of analysis can at least suggest what kinds of changes or stability are most pronounced.

Table 11 shows the mean W levels for all forms of activity for two two-year periods: 1970—71 and 1972—73. These two periods not only break our data into two equal time periods, they also mark a rather general administrative or policy change in the family planning program. The year 1972 marks the beginning of a new five-year plan, with family planning budget changes designed to increase field worker incentives and to smooth out the flow of funds to the field.

For all health centers considered together, there is a significant decline in the amount of seasonal variation over the two periods for all measures except for new acceptors and NCYP. All but the new acceptors seasonal variations show a decrease over time; the new acceptor figure is distinct in showing an increase, though it is not a statistically significant increase. In considering rural and urban areas separately, however, we note that the decline of seasonal variation is a phenomenon only of the rural areas. Here there is a clear and statistically significant decline in the mean level of seasonal variation for IUD activity and for OCP activity. The former is relatively clear and uncomplicated: there appears

Table 11 Changes in Seasonal Variation (W) Over Two Two-Year Time Periods: W_1=January 1970—December 1971; W_2=January 1972—December 1973

W Measure	Mean W Valuses		
	Total (N=191)	Urban (N=52)	Rural (N=139)
New Acceptors			
W_1 NA	.497	.441	.518
W_2 NA	.541	.499	.557
P=	.080	.169	.203
Oral Pill			
W_1 OCP	.346	.324	.354
W_2 OCP	.224	.260	.207
P=	.001	.107	.001
W_1 TA	.255	.267	.251
W_2 TA	.200	.245	.183
P=	.001	.437	.001
IUD			
W_1 IUD	.616	.508	.656
W_2 IUD	.573	.508	.597
P=	.003	.971	.001
W_1 NCYP	.603	.527	.632
W_2 NCYP	.573	.493	.603
P=	.030	.210	.071
W_1 TCYP	.488	.397	.522
W_2 TCYP	.437	.387	.456
P=	.001	.997	.001

to have been a decline in seasonal variation of IUD recruitment from one period to the next.

The decline in OCP seasonal variation is complicated by the *increase* in new acceptor seasonal variation. We must recall again that the OCP data include both new and revisiting acceptors, IUD data are primarily new acceptors. If the new acceptors seasonal variation has increased while total OCP acceptors and IUD acceptors seasonal variation have decreased, it appears that the new OCP seasonal variation may have actually increased from one period to the next. It is not at all clear why this should have occurred, although we did observe some complimentarity between OCP and IUD in the rural seasonal variation that is related to health center productivity. Thus the decrease in IUD variation might have been purchased by an increase in new OCP variation.

Data for the analysis of change or stability in peak periods is found in Table 12. Here we show for each of the four year periods the proportion of health centers that experienced maximum activity in the previously identified peak months: December for the OCP and March for the IUD. Again, interest must focus on the difference between patterns of change and stability in rural and urban areas, and for the two method atcivites. For the urban areas OCP activity, clustering around the December peak has been almost completely eliminated, and there has been a mild shift to a June cluster. For rural area OCP activity, there has been a less pronounced decline in the December cluster, which has not been markedly compensated for by a rise in the summer cluster. Thus in both areas there has been a smoothing out of seasonal peaks, with the December peak losing some of its dramatic character.

For IUD activity the urban areas show erratic movements between fall, spring and winter. The rural areas retain their March peak throughout the four years. If the three spring months (March, April and May) are considered together, in each year we have half or more of the health

Table 12. Per Cent of Health Centers in Peak Month and in Next Highest Month for OCP and IUD Activity in Urban and Rural Areas.

Year	OCP		IUD	
	% in Peak Month	% in Next Highest Month	% in Peak Month	% in Next Highest Month
All Health Centers				
'69-70	30% (Dec.)	15% (June)	19% (March)	9% (Nov.&(Dec.)
'70-71	34% (Dec.)	16% (Nov.)	21% (March)	14% (Oct.)
'71-72	38% (Dec.)	13% (Nov.)	20% (March)	10% (Oct.)
'72-73	23% (Dec.)	13% (May)	18% (April)	15% (Jan.)
Urban Health Centers				
'69-70	29% (June)	23% (Dec.)	17% (Nov.)	15% (April)
'70-71	25% (Dec.)	15% (June)	27% (Oct.)	16% (May)
'71-72	17% (Dec.)	15% (June)	25% (May)	13% (Oct.)
'72-73	19% (June)	7% (Dec.)	19% (Jan.)	17% (April)
Rural Health Centers				
'69-70	32% (Dec.)	13% (Nov.)	24% (March)	9% (Dec.)
'70-71	37% (Dec.)	18% (Nov.)	25% (March)	11% (Feb.)
'71-72	45% (Dec.)	14% (Nov.)	19% (March)	9% (Sept.)
'72-73	29% (Dec.)	11% (May)	22% (March)	13% (Jan.)

centers showing their peak activity. It appears that the impact of the agricultural work cycle on IUD acceptance is powerful and consistent and not amenable to manipulation through manipulation of overall program characteristic.

10. Summary and Conclusions.

Seasonal variation appears to be primarily an issue for IUD acceptance. Not only is OCP variation less in magnitude, it seems in the urban centers unrelated to the environmental and organizational variables that have a marked impact on IUD variation. Thus it is difficult to construct even a plausible explantion for seasonal variation in urban OCP activity. For IUD seasonal variation, the variety of conditions that affect its magnitude and period permit us to construct a plausible explanation that is both consistent with many different observations and also has at least potentially important policy implications.

The consistent negative relationship between health center productivity and seasonal variation in both rural and urban areas supports the hypothesis that seasonal variation is some form of organizational weakness and not a rational adjustment to given conditions, at least for the IUD activity. From what we know of the conditions of health center productivity from the ESCAP study, it does appear that seasonal variation represents at least in part a less-than-optimum internal resource allocation pattern in the health centers.

The impact of environmental conditions is clear, if not always understandable. Seasonal variation for IUD activity is higher in rural than in urban areas, and is positively related to both agricultural work and to population density. We observe the latter impact but have no satisfactory explanation for it. The impact of the former is easier to understand and to integrate into a larger model, which emphasizes urban-rural differences and focuses upon the rural health centers for the fullest explanation of seasonal variation.

In the rural areas the agricultural work cycle has an independent and hypothesized or fundamental impact that produces a high degree of seasonal variation. The rural conditions itself implies greater distances and larger transportation costs (either in time or cash costs). Partly because of this the climatic condition has an impact on seasonal variation such that bad weather reduces population movement and better weather increases such movement. The climatic effect works on both acceptors and program personnel. For acceptors the climatically induced movement is amplified by the economic condition of the farm household in such a way as to produce a high degree of movement and IUD acceptance in the spring, when labor requirements are not very high and cash incomes from other than major crops are substantial. Thus the special significance of spring in the agricultural cycle works on acceptors through both climatic and economic conditions; it works on program personnel largely through climatic effects that favor movement.

The weaker, or perhaps even the average health center in the rural areas will simply react to this powerful environmental impact by accepting a high degree of seasonal variation in IUD activity. If additional administrative problems appear, such as shortages or delays in payment of doctor's fees for insertions, this will only and to the amount of seasonal variation. With its less powerful staff complement, less effective relations with other units and poorer staff attitudes, the less productive health center is in no position to do anything other than accept the impact of the environmental conditions and to permit higher levels of seasonal variation.

The stronger, more efficient, or more productive health center does more than accept the environmental impact, however. It engages in a dynamic adaptation to the environment that both increases its productivity and reduces the amount of seasonal variation it experiences. The more productive health center has a better staff pattern, or more highly qualified staff. It has good relations with other units, both in other professional services and in the local civil administration. These better relations help to smooth the flow of payments and supplies so that the center experiences fewer shortages or delays in supplies and payments. Payments to doctors for insertions flow smoothly and staff payments for incentive and transportatoin arrive on time and in proper amounts. The better attitudes, higher morale, and better logistics probably mean that staff are more active in moving out to prospective clients to work on personal recruitment. Further, the better center has good relations with other units, even to giving freely of staff time in support of other units. The net impact is to raise IUD recruitment to higher levels throughout the year, in the non-peak spring months, and thus to reduce overall seasonal variation. It also appears, however, that the better center recognizes the clear impact of the spring peak,and adjusts in part to this impact by allocating resources less to the OCP recruitment in the spring and more to the OCP recruitment in the less active IUD months. Thus the better centers show higher levels for seasonal variation in OCP activity than do the weaker centers.

This model is at least consistent with our data, although we cannot claim that it is fully confirmed. It is accurate, it does have some important policy implications. First, it is especially useful to note the considerable difference implied by the urban and rural health center environment. This difference in the environment implies that different programmatic strategies should be adopted for the different areas, and it may not make sense to attempt to use a standard programmatic strategy for all types of environments. For example, the spring peak for IUD acceptance is quite pronounced in rural areas, and seems to be integrally related to the agricultural climatic cycle. Rather than attempt to reduce seasonal variation around this peak, it might make sense to use this environmental stimulant for ***annual spring campaigns of IUD recruitment***. The spring campaign might be one that utilzed staff assistance from other agencies and the civil administrative system on a cooperative loan basis. Family planning staff can return the staff assistance to the other agencies in less acitive periods. We have already seen that this type of cooperative work does enhance productivity in the rural areas ***but not in the urban areas***. Thus it might be useful to take advantage of this positive impact of cooperation to make a more effective adaption to the acceptance period that occurs in the spring. The outcome might well be an increase of seasnal variation, but it would be planned to combine advantages of environmental conditions and the conditions of interorganizational cooperation that already exist in the rural areas. Such a policy could also use the oral contraceptive pill quite openly as an adjustive mechanism, giving it second priority to IUD recruitment especially in the spring, and greater priority in other periods.

We could not expect such a spring campaign strategy to work in the urban areas. First the urban areas lack a pronounced peak period of which to take advantage. Second, although we did find that productivity is negatively associated with IUD seasonal variation, we found no complementary positive relation between productivity and OCP variation. Thus it does not appear possible to use one method to balance the seasonal variation of the other. Finally, we found in the ESCAP study a negative relationship between productivity and inter-agency cooperation, indicating that the family planning program is not likely to gain anything, indeed it stands to lose in performance, by giving time away to other agencies.

This analysis clearly supports a basic finding of the ESCAP administration study. Rural and urban areas are different and require different strategies for effective program performance. More generally, family planning organizations, like other organizations, will increase performance levels by working out a more effective adaptation to their environments. Among other things, this implies that the environment must be taken into account in a systematic manner, and that specific strategies should be developed to fit varying environments. This kind of sensitive adjustment to the environment is something that goes on at least informally in highly productive organization. Our analysis of seasonal variation and the ESCAP administration study may help to indicate how that adjustment can be made a more deliberate part of family planning policy.

References

O.D. Duncan and P. M. Blau, *The American Occupational Structure*, New York: John Wiley & Sons, 1967.

O.D. Duncan, D.L. Featherman, and B. Duncan, *Socioeconomic Background and Achievement*, 1972.

Kwang-Woong Kim, *A Comparative Study on the Administration of family Planning Programmes in the ECAFE Region for the Korean Nationl Study*, Bangkok, Thailand: ESCAP Population Division, 1975.

K.W. Kim and G. D. Ness, *ESCAP Study on Family Planning Administration in the Republic of Korea: Interpretative Summary*, Bangkok, Thailand: ESCAP, Population Division, 1975.

Taek Il Kim, John A. Ross and George C. Worth, *The Korean National Family Planning Programme*, New York: The Population Council, 1972.

R.J. Lapham and W.P. Mauldin, "National Family Planning Programmes, Review and Evaluation," *Studies in Family Planning*, 3 (March) New York: The Population Council.

Dorothy Nortman, "Population and Family Planning: A Fact Book" *Reports on Population/Family Planning*, No. 2, 7th Edition, (October, 1974).

George C. Worth, "Seasonal Shift in Numbers of Acceptors," Mimeo, Seoul, Korea, March, 1974.