Appendix. Polar Vectors

The vector, in a simplified manner, can be understood as a point in space that must be immersed in coordinates in order to be located. Vectors can be seen as a polar combination of a magnitude and a direction (magnitud= ***r*** and dirección=θ) or as a rectangular combination (***x*** and ***y*** components on a Cartesian plane).

In medicine we are familiar with the rectangular-type coordinates, the ***x*** and ***y*** axes, that represent the relation between two variables, regardless of the units in which they are measured.

Polar coordinates include an angle that is measured from the positive part of the ***x*** axis. The origin of the coordinates is called the pole, and the straight line is called the polar axis.

If **P** is a point on a two-dimensional plane, then it can be represented as a distance of ***r*** from the origin **O** and it can be found at a certain angle θ of the **A** axis **(figure 1)**. Even though a vector with a magnitude the opposite of ***r*** can be represented as ***–r***, the angle could also be enough to indicate direction. These angles go from 0° to 365°. However, in some cases, vectors can represent functions that imply rotation, and in cases such as these, the angles are greater than 360°. This representation ability is an advantage that polar coordinates have over rectangular ones.

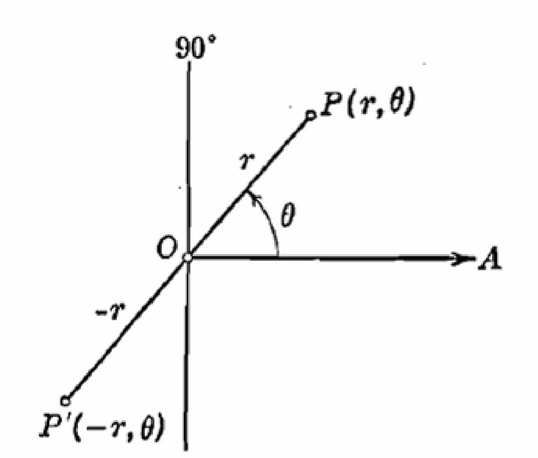

Figure 1. A polar vector represented by a point P that has magnitude and direction is shown. The sense of the vector would be provided by an arrow that, in this case, is not shown.

Polar coordinates can be seen as various concentric points that show the magnitude of the different points that, in turn, are found in different directions (**figure 2**).

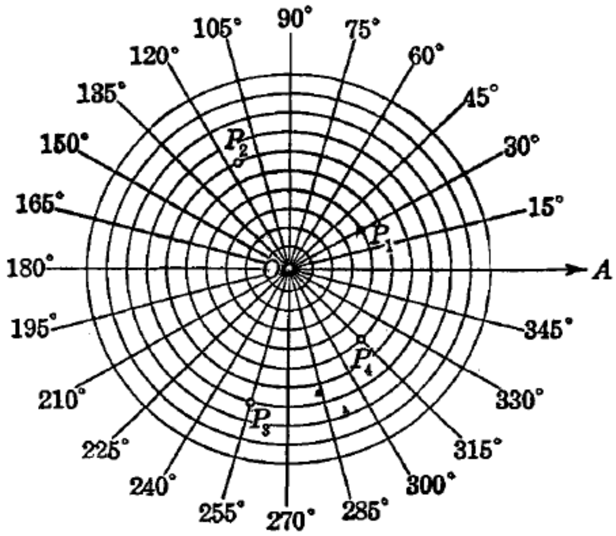

Figure 2. Graph showing polar coordinates with concentric circles that represent the magnitude of points P1 to P4, as well as the directions shown by the angles.

Vector magnitude can be measured using the Pythagorean theorem, in which the hypotenuse corresponds to magnitude and the catheti are the combination of ***x*** and ***y*** values. Direction is obtained with the arctangent of the ***y/x*** relation.

The effect of a common treatment for IBS-constipation and one for IBS-diarrhea should result in opposite senses in reference to evacuation improvement using the Bristol matrix, but this problem disappears when clinical improvement is represented using polar vectors.

This approach to evacuation frequency and type is what is referred to as the omnibus variable in this study.