

Chapter 8 Mineral & Molecular Balance

Calcium, Phosphorous & Potassium

Albumin, Alkaline Phosphatase & intact Parathyroid Hormones

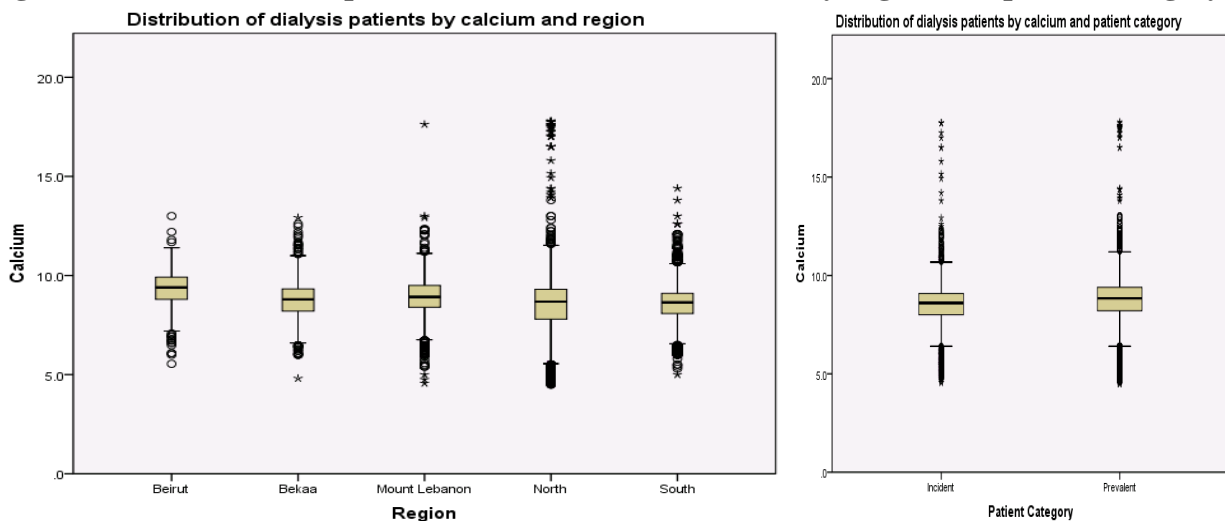
Phosphate binders & vitamin D supplements

Mineral and related molecular imbalance with concurrent metabolic acidosis and osteodystrophy is another core component of ESRD. While on maintenance HD, these pathologies grow more serious and have to be regulated through dietary adjustments, the use of phosphate binders and vitamin D supplements and the management of molecular disorders. As described in chapter 5, over 1/3 of patients starting HD in Lebanon had low serum calcium (Ca) levels, while over a quarter of them had high levels of serum phosphorous (P).

1. Mineral Balance (Ref. table 8.1)

Serum Ca in patients on maintenance HD in Lebanon is generally kept at levels at the low end of normal (**figure 8.1**). Mean Ca was 8.7 ± 1.2 mg/dL (median = 8.8). About a quarter of patients had Ca levels < 8.2 while only 1.2% of patient-months were at levels > 11 mg/dL. Differences by patient category were minimal; however, there were regional differences in proportion of patient-months with Ca < 8 mg/dL: A low of 8.3% in Beirut and a high of 27.8% in North.

Figure 8.1 Distribution of patient-month levels of serum Ca by region and patient category



Phosphorous levels in about 2/3 of patient-months were within an acceptable range for HD patients of 3 – 6 mg/dL (**figure 8.2**). Mean P was 4.9 ± 1.4 mg/dL (median = 4.9). Another 10% of patient-months of P levels were < 3 while 24.8% of patient-months were at levels > 6 mg/dL. Differences by patient category were minimal. At dialysis initiation, about 30% of patients start with P levels > 6 mg/dL, yet despite medications, around 25% of patient-months continue to be higher than 6. There were some regional differences in proportion of patient-months in the acceptable range: A low of 59.8% in South and North and a high of 73.2% in Beirut. The proportion of patient-months of P > 6 was lowest in Beirut (17%) and highest in North (26.9%).

Potassium (K) was generally maintained at high levels (**figure 8.3**). Mean K was 5.4 ± 0.9 mg/dL (median = 5.4). About quarter of patient-months were at K levels > 6 mg/dL. Proportion of patients with hyperkalemia was universal with minimal differences by region or patient category.

Figure 8.2 Distribution of patient-month levels of serum P by region and patient category

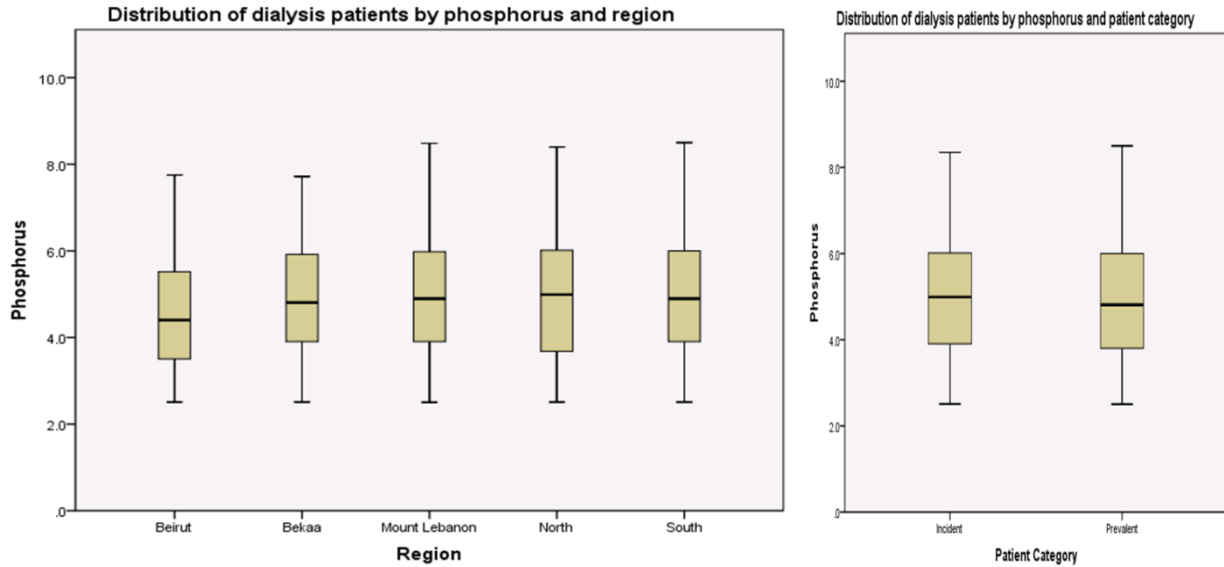
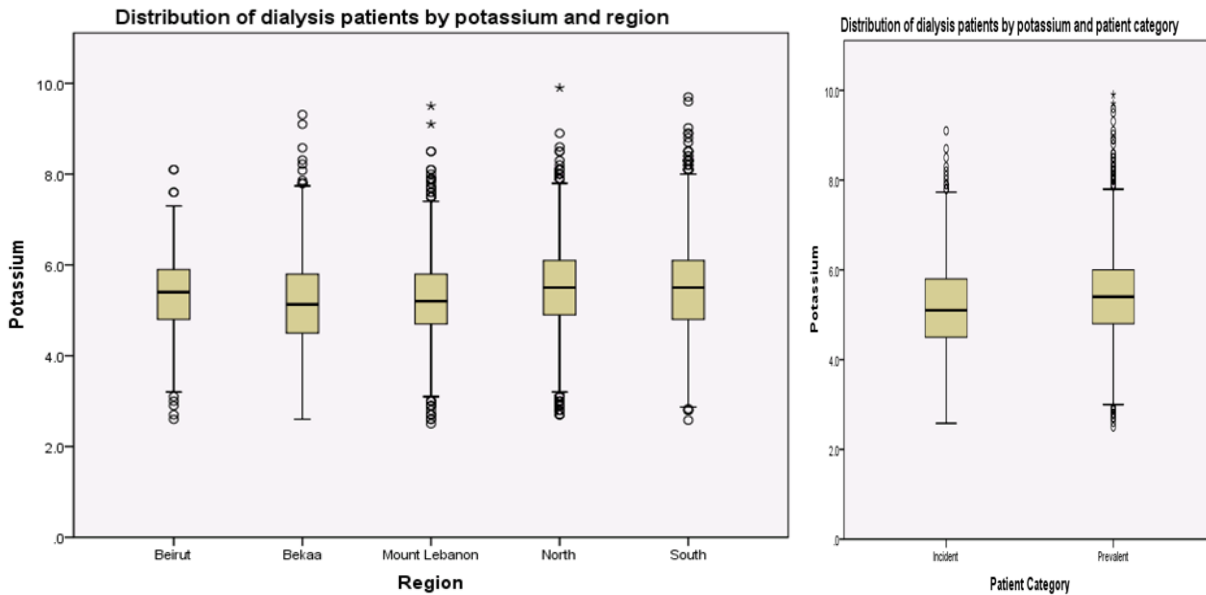


Figure 8.3 Distribution of patient-month levels of serum K by region and patient category



2. Molecular Balance (Ref table 8.2)

At HD initiation, more than half the patients had low Albumin (mean=3.5, median=3.6 g/dL) and high iPTH (mean=418, median=303 pg/ml). On maintenance HD, these problems are partially corrected.

Albumin levels improved from low levels at initiation into a mean of 3.8 ± 0.5 g/dL (median = 3.9), but still over a quarter of patients continue to have low levels < 3.6 (**figure 8.4**). A larger proportion of recent starters had low levels (36% of patient-months) compared to earlier starters (25.4% of patient-

months), indicating that this improvement occur gradually over the first few years, or this may be a reflection of the fact that patients who survive past the first couple years on HD, have better overall clinical wellbeing, hence better levels of albumin. There were large differences between regions of Lebanon (**figure 8.5**), with the highest mean albumin in Beirut at 4.1 g/dL, with 8.7% of patient-months < 3.6; and the lowest in South at 3.5 g/dL, with 65.3% of patient-months <3.6.

Figure 8.4 Distribution of patient-month levels of albumin by region and patient category

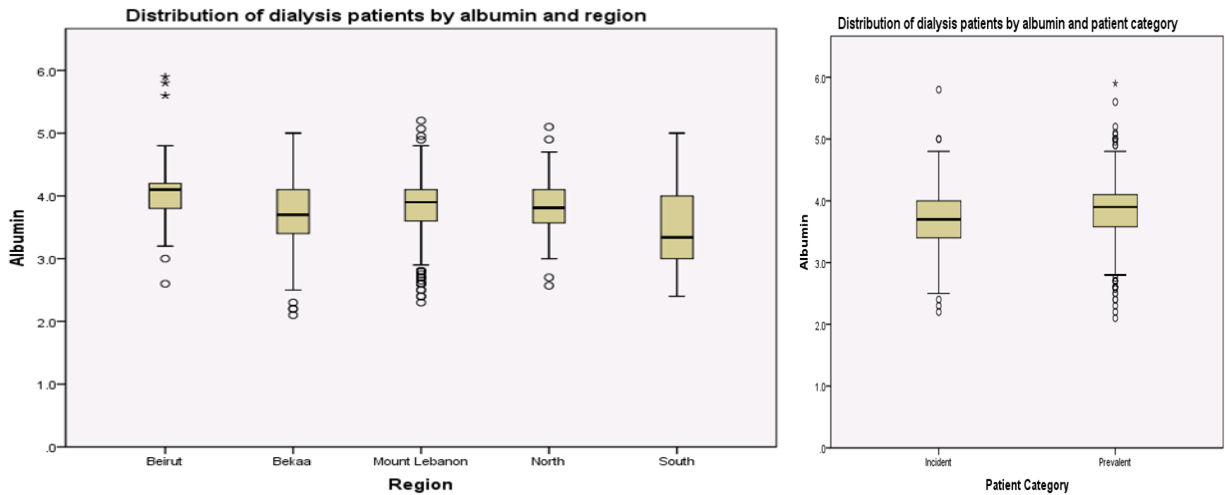
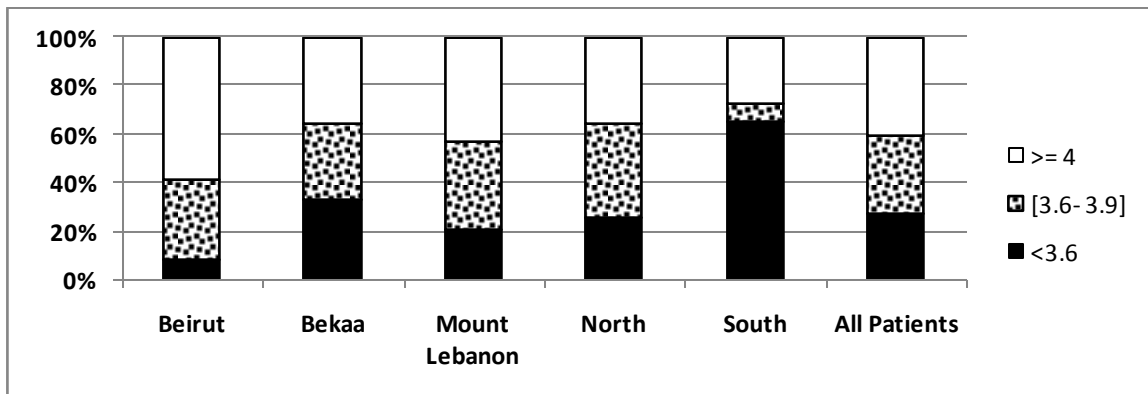


Figure 8.5 Distribution of HD patients by albumin levels by region



Intact PTH also improved with maintenance HD compared to initiation (mean iPTH = 375.9 pg/ml, median = 235), especially in recent starters (**figure 8.6**). The skewness to the right (mean higher than median) is due to a small number of patients who have high levels of iPTH. Regional differences are quite large (**figure 8.7**). Lowest levels were in Beirut: mean = 269.7, median = 150 and only 26.8% of patient-months were > 300 pg/ml. Highest levels were in South: mean = 467.8, median = 349 and 55.9% of patient-months were > 300 pg/ml.

Alkaline Phosphatase levels remained stable at levels similar to dialysis initiation: mean = 114.7 and median = 93 U/L. Differences by patient category or region were minimal.

Figure 8.6 Distribution of patient-month levels of iPTH by region and patient category

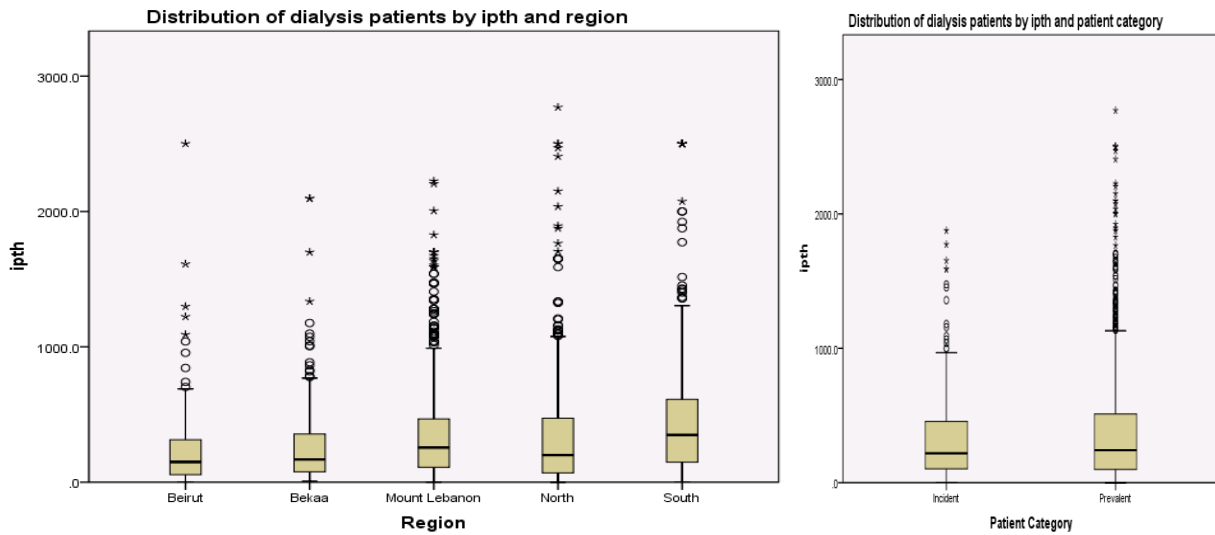
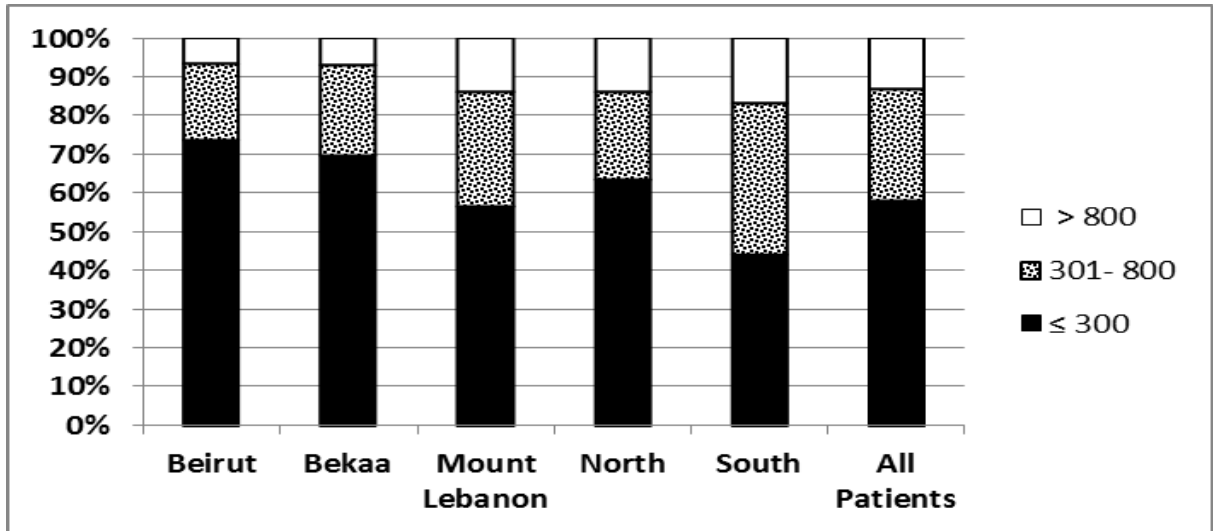


Figure 8.7 Distribution of HD patients by iPTH levels by region

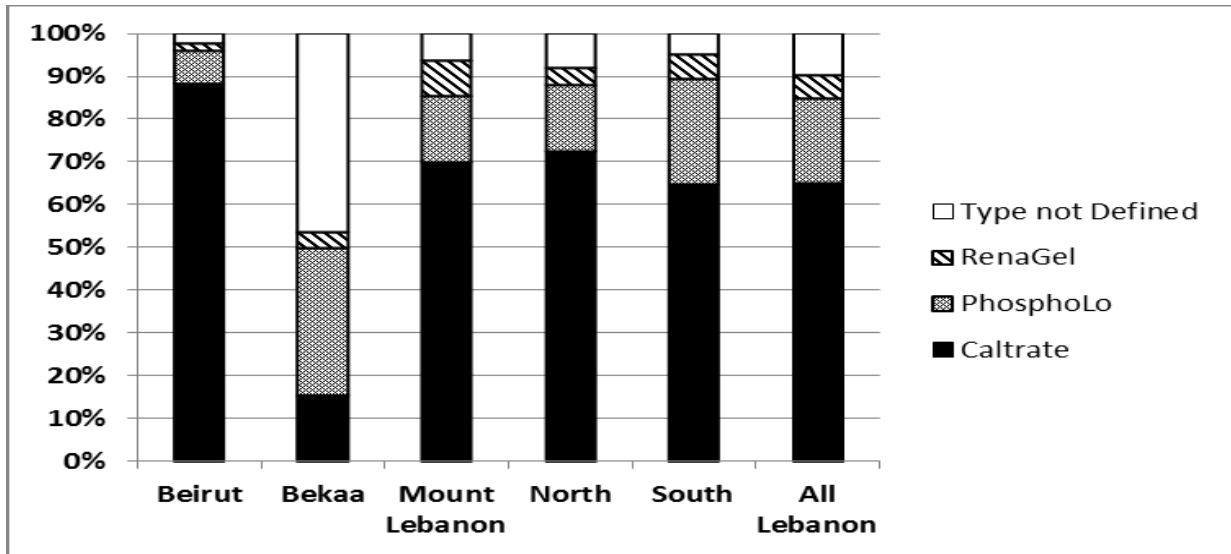


Phosphate Binders and Vitamin D (Ref. table 10.1)

Mineral balance is a critical component of clinical management of a HD patient. A combination of nutritional regulation, phosphate binders, hormonal control and occasional surgery are needed to accomplish that goal. This module did not capture any data on hyperparathyroidism or any specific therapies or surgery related to it.

Phosphate Binders were used in 88.1% of HD patients in Lebanon, for an 83.2% proportion of total patient-months. The highest use was in South for 96.3% of patients in 86.3% of patient-months, while lowest use was in North for 83.5% of patients in 76.3% of patient-months. Dosage data was not collected. Two types of phosphate binders were commonly used (**figure 8.8**): Caltrate (65.1% of patients) and Phospho-Lo (19.6% of patients) with minimal use of RenaGel (5.4%).

Figure 8.8 Types of phosphate binders used in Lebanon by Region



Vitamin D supplementation aims to provide high doses of vitamin D to compensate for impaired calcium absorption in the guts and maintain serum calcium and phosphorous at acceptable levels to aid in bone growth and remodeling. Two hydroxylation products are necessary for physiologically active vitamin D: calcidiol (occurs in liver) and calcitriol (generated in kidneys). Hence, supplementation may consist of two components: one as precursor to calcidiol (vitD-1 α) and another as the enzyme calcitriol substitute.

VitaminD-1 α : Was used in either oral or IV form (or both) in 67.3% of patients for 51.8% of total patient-months. The oral form of the supplement was given in 64.3% of patients and the IV form was given in 13.9% of patients.

Calcitriol: Is not available in the Lebanese market.